OBSERVATIONS

OF

DOUBLE STARS

MADE AT THE

UNITED STATES NAVAL OBSERVATORY,

BY

ASAPH HALL,
PROFESSOR OF MATHEMATICS, UNITED STATES NAVY.

REAR-ADMIRAL JOHN RODGERS, U. S. N.,
SUPERINTENDENT.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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INTRODUCTION.

§ 1.

My regular observations with the 26-inch Refractor of the Naval Observatory were begun in the spring of 1875, the instrument at that time being in charge of Professor SIMON NEWCOMB. Professor NEWCOMB gradually withdrew from observing with this instrument, which came under my direction sometime in July of the same year. The micrometrical measurements which had been made by Professors NEWCOMB and HOLDEN were chiefly of the satellites of Uranus and Neptune, and the discussion of these measurements of the two outer satellites of Uranus brought out very clearly what had been indicated before by Von Asten; viz, the existence of a large constant difference in the angles of position measured by Mr. OTTO STRUVE, director of the Imperial Observatory at Pulkowa. As it is our intention to repeat the measurements of the satellites of Uranus and Neptune after a few years, and as it seemed probable that similar differences might exist in the observations of double stars, it occurred to me that the best way of comparing and uniting the observations of different astronomers would be for each one to observe the same double stars at nearly the same time. I wrote to STRUVE proposing that this should be done, and that he should select the list of stars. In reply he informed me that such a series of observations was already in progress between himself and Baron DEMBOWSKI, and after adding to the list of stars a few of greater distances this list and an account of the proposed work were published by STRUVE in the "Vierteljahrsschrift der Astronomischen Gesellschaft." Band xi, p. 227.*

It was understood that each observer should avoid all knowledge of the observations of other astronomers, in order that his work might be done independently, and in my own case this rule has been carefully adhered to. But now nearly four years have elapsed since STRUVE's publication, and it is probable that all the astronomers engaged in this work have collected such a number of observations that the publication of my own results will not influence the independence of theirs. Moreover, the end of the year 1879 seems to be a favorable epoch for publishing my observations of double stars made before 1880, since I hope to make some changes which in the future will enable me to observe under conditions more favorable to accuracy.

I have therefore collected and revised all my observations of double stars, and the results are given in the following pages. In order to make this collection complete I have included the few observations made in the year 1863 with the equatorial of 9.6 inches aperture. The whole number of observations is 1614.

* Mittheilung über unternommene Beobachtungsreihen zur Vergleichung von Mikrometermessungen. 1876, Anfang Juni. OTTO STRUVE.

§ 2.

It will not be necessary to give any general description of the 26-inch Refractor made by ALVAN CLARK and SONS for the Naval Observatory, since such descriptions can be found in the annual volumes of the Observatory for 1873 and 1874. It will be sufficient to refer here only to those matters which are more closely connected with the micrometrical measurements.

The form of the mounting adopted by the makers for this Equatorial is such that the instrument, notwithstanding its great size, is handled with ease; and the harp-shaped piece that supports the polar axis is very convenient when observing near the zenith. Generally the instrument is pointed on a star by means of what are called the "rough circles." These circles are the edges of the hour and declination circles, which were painted white, and then divided by lines of black paint, the hour circle into spaces of ten minutes of time and the declination circle into degrees. This method of pointing is usually accurate enough to find the object, but as the painting was not well done errors as great as 15′ to 20′ could be made in some parts of the rough declination circle. An accurate reading for the position could be made by means of the finely divided circles, but this involves considerable time and trouble. On account of the delay in the observations which would be caused in making the change, and of the natural inertia in getting rid of a poor thing to which one has become accustomed, this defective circle for the declination was used until June, 1879, when the circle was painted white and divided again under the care of Mr. GARDNER, the instrument-maker of the Observatory. The settings are now much more accurate and give but little trouble, and the saving of time is very great. It is possible that a few cases may be found where, on account of an erroneous setting in declination, I have observed a different object from the one supposed.

The ease and rapidity with which observations can be made with a filar micrometer depend largely on the performance of the driving-clock. The accuracy of the observations also is in a measure dependent on this performance, but patience and skill on the part of the observer will in a good degree make up for a poor performance of the clock. The motive power of our driving-clock comes from a small water-wheel which is driven by water drawn from the Potomac water pipes. At first the water was applied directly to the conical pendulum, but the pressure of the water was so variable that weights attached to an endless cord, (Huygen's loop), were placed between the water-wheel and the pendulum by Professor NEWCOMB. When this had been done the performance of the clock is said to have been tolerable; but in the autumn of 1875 it became very troublesome, and the observer was frequently annoyed by the stopping of the clock. This trouble continued and became worse until July, 1876, when the clock was dismounted by Mr. GARDNER and myself. The lower end of the shaft of the conical pendulum had been given a conical shape, and had rested in a conical cup. The friction and heat had been so great that the lower end of this shaft had become very rough and twisted to a gimlet shape, thus stopping the clock. The bearing of the shaft was changed and made of a plane agate surface, the lower end of the shaft being rounded to a slightly curved surface. The friction of the upright shaft of the water-wheel was also diminished by clamping a set of friction wheels to

this shaft and letting them play on a horizontal iron surface. The weights on the Huygen's loop were changed for cups carrying shot. With an average pressure of the water, and the machinery well oiled, these weights are 7½ and 3½ pounds, but the weights can be varied to suit the resistance and the pressure by changing the shot. Since these changes the performance of the clock has been tolerably good. Still this clock needs much care, and being dependent on an unsteady pressure of water a delay in the observations sometimes occurs. The great length of the telescope, which exposes it to the action of the wind, is also a hinderance to the steady driving of the clock.

The difficulty in turning the dome, of about 42 feet diameter, has increased. This difficulty is caused probably by the uneven settling of the supporting walls, and the bulging of the dome in the direction of the slit. The labor of turning the dome through a revolution is so great that lists of north and south objects are prepared beforehand by the observer in order to avoid as much as possible the turning of the dome.

The position of the pole of the instrument has been found by observing Polaris and two equatorial stars, each star being observed in both positions of the instrument. At first the readings of the finely-divided circles were so confused that nothing could be derived from the observations, but this trouble was remedied by engraving on the verniers of the declination circle small arrows that indicate the direction in which the readings must be made, and painting on the holders of the microscopes similar arrows. The declination circle reads to $0'.2$ by means of the verniers, and the hour circle to a second of time by means of the microscopes, and by estimation to a tenth of a second By clamping the instrument in declination and then moving it to different hour angles, I found that the looseness of the instrument in its mountings might cause a small error in the observed declination, the maximum error amounting to $\pm 0'.2$. This looseness seems necessary for so large an instrument, in order to insure ease of motion with varying temperatures, and the error is so small that it has been neglected. If we denote by i the angle between the declination axis and the plane of the hour circle, and by c the collimation error of the telescope, or the difference from a right angle of the angle between the axis of the telescope and the declination axis, I find from the observations of December 13, 1876, and of January 9, 1877, the values

$$i = -0'.14; \qquad c = +0'.15.$$

These quantities should be small in a well-constructed equatorial, and such is seen to be the case with our instrument. If λ be the distance of the pole of the instrument from the pole of the heavens, and h its hour angle, the observations have given the following results:

Date.	λ.	h.
1876, December 13,	1'.62	169°.88
1877, January 9,	1 .63	170 .30
1878, January 3,	1 .42	160 .67
1879, May 22,	1 .66	147 .27
1880, January 29,	1 .65	139 .95
1880, January 31,	1 .82	136 .38

If τ be the hour angle of the object and δ its declination, the correction to an observed angle of position will be

$$\lambda \sin (\tau - h) \sec. \delta.$$

In all of my observations this correction is insensible. Moreover, I have generally determined the zero of the position circle in the part of the heavens where the observations were made. The values of λ show that the distance of the pole of the instrument from the pole of the heavens has remained nearly constant. The changes in the values of h are of little importance, but they might be anticipated, I think, from the form of the pier and the mounting, apparently too slender in the direction perpendicular to the meridian.

Our observations have shown no sensible flexure of the tube, and the micrometrical measurements are independent of such an error. It is interesting, however, to know the flexure of a tube like this, made of thin sheet steel and 31 feet long. The north-polar distances of the following stars were observed near the time of their culmination, each star being observed in both positions of the telescope, and after applying the corrections for refraction the instrumental positions of the stars were as follows:

1880, April 17: Ther. 62°.0 F.

	N. P. D. °	′
15 Argus	113	59.67
ϵ Hydræ	83	10.35
ι Ursæ Majoris	41	31.12
κ Cancri	78	52.86
α Hydræ	98	10.64
μ Leonis	63	27.63
32 Ursæ Majoris	24	19.46
9 Draconis	13	41.92
226 Cephei, S. P.	345	38.00

Denoting by z the zenith distance of the star, and by ϵ the flexure of the telescope, the equation for the flexure is of the form

$$\xi + \sin z \,.\, \epsilon + n = 0.$$

Comparing the observed positions with the known we have the following equations of condition:

Equations.	Residuals.
°	′
$\xi + 0.8902\,\epsilon + 1.82 = 0$	-0.02
$\xi + 0.5156\,\epsilon + 1.66 = 0$	-0.16
$\xi - 0.1670\,\epsilon + 1.84 = 0$	$+0.06$
$\xi + 0.4656\,\epsilon + 1.71 = 0$	-0.11
$\xi + 0.7319\,\epsilon + 2.00 = 0$	$+0.16$
$\xi + 0.2136\,\epsilon + 1.79 = 0$	-0.01
$\xi - 0.4510\,\epsilon + 1.85 = 0$	$+0.09$
$\xi - 0.5216\,\epsilon + 1.77 = 0$	$+0.01$
$\xi - 0.9190\,\epsilon + 1.63 = 0$	-0.10

The normal equations are

$$+ 9\,\xi + 0.7673\,\varepsilon + 16.07 = 0$$
$$+ 3.1878\,\varepsilon + 1.57 = 0$$

and hence

$$\xi = - 1'.79 \pm 0'.025; \qquad \varepsilon = - 0'.064 \pm 0.'043.$$

The flexure coefficient is therefore insensible.

§ 3.

The filar micrometer with which the following observations have been made is the one originally furnished by the makers. The screw of this micrometer has been examined by Professors NEWCOMB and HOLDEN, and by myself, and has proved to be excellent. A very complete investigation of the value of a single revolution of the screw has been made by Professor HOLDEN, who has determined this value by several independent methods. His adopted value of a single revolution is

$$R = 9''.9479.$$

The value of a revolution is the same throughout the part in use, and there appears to be no sensible term depending on the temperature. I have used the above value in all my reductions.

In this micrometer the additional screw, which in the Fraunhofer micrometer moves what is called the "fixed wire," is placed outside the micrometer box, and is a common screw which moves the entire micrometer plate without altering the relation between the wires. This arrangement is convenient for enabling one to make a deliberate measure of the distance; and it also gives the means of partially counteracting an incorrect motion of the driving-clock. On the other hand, in this micrometer the fixed wire always remains at a certain point, or the coincidence of the wires has a constant reading, which is about $64^{r}.1$. If therefore there is a periodical error of the screw, or any peculiarity pertaining to a certain part of it, the result of a large number of accurate measurements of a given distance will be to establish this distance with a small probable error, but affected with an unknown constant error. A continual shifting of the coincidence of the wires, as in the micrometer used by Professor BRÜNNOW at the Dunsink Observatory, is perhaps the best method of avoiding the periodical errors of a screw. In such a micrometer the individual measures will be more discordant, but the mean result will be more trustworthy. In our micrometer therefore the periodical errors need to be carefully examined. An examination of these errors was made by Professor NEWCOMB in 1874, by means of Professor HARKNESS's Measuring Engine; and a statement of the result of this work is given in the annual

volume of the Naval Observatory for 1874, p. LXX of the Introduction. This examination was repeated by Professor HOLDEN in 1876, who found likewise that the periodical errors were insensible. In order to leave no doubt on this point I have again repeated this examination.

The micrometer of the Equatorial was placed under the Harkness Measuring Engine on May 6 and May 7, 1880, and the distance corresponding to each one-tenth of a revolution of the screw was measured by means of the micrometer belonging to the engine. These measures were made at a temperature of 79°. They were extended over the ten revolutions, from 59^r to 69^r; and generally each result depends on three settings of the engine-micrometer, but in a few cases on six settings. The following table gives the results of these measures, which are corrected for errors in the scale of the engine:

	Δ		Δ		Δ		Δ		Δ
r.		r.		r.		r.		r.	
59.0	0.644	60.0	0.621	61.0	0.622	62.0	0.617	63.0	0.628
.1	0.597	.1	0.622	.1	0.625	.1	0.620	.1	0.618
.2	0.631	.2	0.611	.2	0.619	.2	0.640	.2	0.620
.3	0.635	.3	0.634	.3	0.630	.3	0.583	.3	0.619
.4	0.612	.4	0.604	.4	0.627	.4	0.634	.4	0.632
.5	0.637	.5	0.639	.5	0.610	.5	0.622	.5	0.615
.6	0.613	.6	0.620	.6	0.618	.6	0.628	.6	0.611
.7	0.612	.7	0.619	.7	0.604	.7	0.622	.7	0.630
.8	0.632	.8	0.618	.8	0.621	.8	0.610	.8	0.622
59.9	0.611	60.9	0.626	61.9	0.620	62.9	0.629	63.9	0.630

	Δ		Δ		Δ		Δ		Δ
r.		r.		r.		r.		r.	
64.0	0.628	65.0	0.605	66.0	0.595	67.0	0.645	68.0	0.616
.1	0.629	.1	0.629	.1	0.636	.1	0.628	.1	0.625
.2	0.601	.2	0.614	.2	0.630	.2	0.615	.2	0.601
.3	0.645	.3	0.616	.3	0.607	.3	0.614	.3	0.629
.4	0.606	.4	0.618	.4	0.627	.4	0.616	.4	0.625
.5	0.621	.5	0.614	.5	0.617	.5	0.631	.5	0.621
.6	0.620	.6	0.638	.6	0.630	.6	0.609	.6	0.639
.7	0.623	.7	0.610	.7	0.618	.7	0.606	.7	0.606
.8	0.627	.8	0.629	.8	0.597	.8	0.630	.8	0.603
64.9	0.623	65.9	0.625	66.9	0.643	67.9	0.638	68.9	0.640

Taking the means for each tenth of a revolution, we have

Micr.		Δ	Residuals.
r		d.	
0.0 to	0.1	0.6221	+ 9
0.1	0.2	0.6229	+ 17
0.2	0.3	0.6182	− 30
0.3	0.4	0.6212	0
0.4	0.5	0.6201	− 11
0.5	0.6	0.6227	+ 15
0.6	0.7	0.6226	+ 14
0.7	0.8	0.6150	− 62
0.8	0.9	0.6189	− 23
0.9	0.0	0.6285	+ 73
Mean: $\Delta = 0.6212 = 0''.995$			

The probable error of a single set of three pointings is, if we neglect the periodical terms,

$$\pm\, 0^d.00804\,; \text{ or in arc } \pm\, 0''.0129$$

If, now, we compute the probable error of such a set from the residuals of the single pointings I find it to be $\pm\, 0''.0045$. This result shows that the largest part of the probable error has come from disturbance of the micrometer wire, or peculiarities that belong to each setting. The plate of the micrometer was fastened down with bees-wax, and great care was taken in moving the wire, but some disturbance is indicated by the values of Δ.

Denoting the correction of the reading of the head of the micrometer by $\varphi\,(u)$, where u is the angular value of this reading, and assuming that the residuals have a periodical form, we have

$$\varphi\,(u) = +\,0''.0002 \sin u + 0''.0022 \cos u - 0''.0022 \sin 2\,u + 0''.0047 \cos 2u$$

This correction can generally be neglected, and this screw appears to be practically free of periodical errors.

It remains to determine the effect of changes of temperature on the screw, and this can be done best by observing the difference of declination of two stars near the north pole, where they can be observed in summer and in winter. Hitherto this correction has been assumed to be insensible.

The wires of the micrometer have been broken or removed several times, generally in changing the eye-pieces in cold weather, or on account of small spiders getting on them, but they have been restored by Mr. GARDNER with webs from the same cocoon. These wires are soaked in warm water, and then stretched to about three times their natural length before they are inserted. They have given but little trouble by sagging or catching on each other. The thickness of the wires is nearly $0''.2$.

The wires are illuminated with a red light, which is obtained from a lamp held by an assistant. This light enters the micrometer box through a hole at one end of it, and although the light is thus on one side, the wires always appear round and sharp, and there is very little stray light reflected into the field. In this rather primitive method of illumination a skillful and practised assistant can graduate the amount of light to suit the faintest object. There is also a method provided for illuminating the field, and a few of the observations have been made with this illumination, but nearly all have been made with bright wires in a dark field, and the other cases will be specially mentioned.

The eye-pieces that I have used in my measures are achromatic. These eye-pieces are made after Steinheil's formula, and consist of two lenses, each lens being composed of two glasses cemented together, the flint glasses being outside. In our observing books these lenses are designated as 400 A, 600 A, and 800 A. A power of 1282 has been used on a few occasions and is called 1300. The following is a list of these eye-pieces:

Name.	Maker.	Power.
400 A	Kahler . .	383
600 A	Kahler . .	606
800 A	Steinheil. .	888
1300	Kahler . .	1282

The magnifying powers have been determined by means of a dynameter. A few of my earlier observations were made with a non-achromatic eye-piece, giving a power of 392

The position-circle is 7¼ inches in diameter, and is divided to two-tenths of a degree. It is provided with two verniers, which may be read to a hundredth of a degree, but in observing double stars the circle is read by one vernier and to a tenth of a degree only. There is no eccentricity of this circle that is sensible in these observations. The zero of the circle is determined by turning the wires until a 7th to 9th magnitude star exactly follows the wire through the field; or by setting the circle approximately correct and bisecting the star near its entrance into the field and near its exit, and then by means of the interval of time and the readings of the micrometer computing the correction to the assumed setting.

§ 4.

After some practice, and on becoming familiar with the instrument and micrometer, my manner of observing a double star has been as follows: In order to measure the angle of position the two wires are separated a convenient distance and the stars are placed between them. The position-circle is turned by the hand until both stars appear midway between the wires, and then the circle is read. The light having been taken out of the micrometer, the wires are turned thirty or forty degrees forward and backward

several times before the light is thrown on the wires again for the purpose of making the settings of the circle as independent as possible, and another reading is made. Generally four readings of the position-circle are taken. Then this circle is turned 90° from the mean of the readings and the double distance is measured. First the stars are bisected by the wires and the micrometer is read; then the wires are reversed and the stars are bisected again. The wires are then restored to their original position and another double distance is measured. Two such distances are generally observed. An estimated value of the angle of position is always recorded, as well as the sidereal time of the observation, and also an estimate of the weight of the observation. This weight depends simply on the condition of the images of the stars, and the numbers **1** to **5** are used for expressing the weights; **1** denoting a very poor condition of the images, **3** an average condition, and **5** a perfect condition. I have very rarely observed double stars when the images were so poor as to be given the weight **1**. As far as possible I have avoided all knowledge of the angles and distances observed by other astronomers. In my observing-list these quantities are omitted, and no comparison with other observations is made until my own observations of a star are completed. It is possible, therefore, that in some cases my angles may differ by a multiple of a quadrant from those observed elsewhere.

I have omitted observations of color and of magnitude. These observations have now become a specialty, and such observations as I could make would not do much more perhaps than tend to introduce confusion. In the case of stars observed by the STRUVES, to which most of my observations belong, I have adopted their magnitudes. In most cases these magnitudes are brighter than those of the scale to which I have been accustomed; thus what the STRUVES would call a 7th or 8th magnitude I would call an 8th or a 9th.

Very few of the observations have been made in the twilight, which offers the best conditions for observing double stars, since, the observer residing at a distance from the observatory, it has not been convenient to do this.

With such a large objective great changes occur in the appearance of the stars during a single night. Generally so long as rapid changes of temperature are going on the performance of the object-glass is not good. But on a few nights of the year, when all the atmospheric conditions are favorable, the performance of the glass is excellent, and its separating power is all that could be desired. Usually ruddy and reddish stars are the most difficult to observe, a result which may be caused by the figure of the objective. After having been in use two years the form of the lenses seemed to have undergone a slight change, and in the beginning of May, 1876, the surfaces of the flint lens were refigured by Mr. ALVAN CLARK and his son, Mr. ALVAN G. CLARK. This is the only change that has been made in the objective. On a single occasion water collected between the lenses, and they were taken out, cleaned by Mr. GARDNER, and returned to their cell with very little trouble.

Until March, 1878, all the observations were made with my left eye; but having used my eyes very much during the preceding year, and having done a good deal of computing by gaslight, my eyes became weakened. In March, 1878, while observing the stars in the Trapezium of Orion with a field illumination which was very unsteady,

my left eye suddenly became bloodshot. After a rest of a week the eye resumed its natural appearance, but on observing again the blood reappeared in the eye. I then began to use my right eye, and have used it since in most of the observations. From a number of trials I think that this change of eyes has produced only a small change n my habit of observing an angle of position. Still it is possible that some systematic difference in the angles may exist on account of this change, as there was at first some awkwardness in observing with my right eye. In all my observations the head of the observer was kept in an upright or natural position.

MAY 17, 1880.

OBSERVATIONS OF DOUBLE STARS

SELECTED BY

DIRECTOR OTTO STRUVE,

FOR THE

COMPARISON OF MICROMETRICAL MEASUREMENTS.

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§ 5.

These stars have been observed with the filar micrometer made by A. CLARK and SONS that is commonly used with the 26-inch Refractor. The manner of observing was the same as usual, except that when the distances exceed 20″ the angle of position was observed by bisecting the stars with the wire, and in case of distances that exceed 3″ each observation depends on four measures of the double distance instead of two. The angle of position is designated by p and the distance by s.

The value of a revolution of the micrometer screw used in reducing these measures is

$$R = 9''.9479,$$

and no correction for change of temperature has been applied to this value. The mean value of the correction for differential refraction is denoted by Δp.

The positions of the stars are for the epoch 1875.0, and are taken from STRUVE.

Σ. 170.

$\alpha = 1^h\ 43^m.9.$ $\delta = 75°\ 36'$ (6.7 and 7.8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1878.772	22.1	247.6	3.23	3	606	
8.783	21.1	246.7	3.43	2	383	
8.788	21.4	247.1	3.08	2	606	
8.791	21.8	246.9	3.07	2	606	Images blurred; clouds.
8.794	21.8	247.7	3.13	2	383	Thin clouds.
8.805	21.8	245.9	3.17	2	606	
9.098	3.4	246.7	3.09	3	383	
9.106	4.1	247.1	3.25	3	383	
9.109	4.1	245.7	3.15	2	383	
9.144	4.7	245.6	3.19	3	383	
9.831	23.5	246.6	3.32	2	606	
9.834	22.1	247.4	3.33	3	606	

Σ. 191.

$\alpha = 1^h\ 52^m.1$ $\delta = 73°\ 15'$ (6 and 8.9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1878.772	22.5	188.9	5.57	3	606	
8.783	21.4	188.2	5.57	2	383	
8.788	21.8	188.8	5.55	2	606	
8.791	22.1	186.9	5.62	2	606	
8.794	22.2	186.0	5.49	2	383	Clouds.
8.805	22.1	189.4	5.63	3	606	
9.098	3.7	193.5	5.60	2	383	Clouds.
9.106	4.5	194.0	5.50	2	383	
9.109	4.4	194.9	5.57	2	383	
9.144	5.1	194.4	5.57	2	383	
9.730	22.6	188.8	5.75	2	606	
9.738	20.7	188.0	5.67	2	606	
9.741	20.9	189.5	5.70	2	606	
9.820	22 8	189.9	5.66	2	383	
9.828	23.2	191.6	5.68	2	383	
9.831	23.8	193.7	5.82	2	383	
9.834	22.4	189.7	5.71	2	606	

56 Aurigæ = σ 224.

$\alpha = 6^h\ 37^m.7$ $\delta = 43°\ 42'$ (5.6 and 8.9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.258	8.2	21.04	48.39	2	606	The sky hazy.
7.263	8.5	21.24	48.28	4	383	
7.266	8.6	21.11	48.26	3	383	
7.269	9.7	21.04	48.51	2	383	
7.280	8.4	21.19	48.49	3	606	
7.282	9.8	21.29	. .	1	606	A gale coming up.
7.288	8.7	21.49	48.26	2	606	
7.296	9.8	21.21	48.24	3	383	
7.310	9.1	21.00	48.29	4	606	
7.313	9.1	20.95	48.29	3	606	
	$\Delta\rho =$	+ 0.006	+ 0.014			

Σ. 1169.

$\alpha = 7^h\ 57^m.2$ $\delta = 79°\ 52'$ (7.8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.269	9.4	11.18	20.97	2	383	
7.280	8.8	11.34	20.99	2	606	
7.282	9.5	11.58	20.89	2	606	
7.288	9.2	11.02	20.86	2	606	
7.313	9.6	10.98	20.82	3	383	
7.315	10.0	11.40	21.00	2	383	
	$\Delta\rho =$	+ 0.074	+ 0.008			

Σ. 1321.

$\alpha = 9^h\ 6^m.0 \quad \delta = 53°\ 14' \quad$ (7.8 and 7.8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1877.263	9.0	58.93	19.54	3	383	
7.266	9.0	59.01	19.65	4	383	
7.269	8.8	59.41	19.54	3	383	
7.280	9.2	58.90	19.73	3	383	
7.288	9.5	59.12	19.73	2	383	
7.313	9.9	59.05	19.63	3	383	
9.314	11.2	239.38	19.70	2	383	
9.319	10.2	59.70	19.63	3	383	
9.451	13.5	239.00	19.51	2	383	
	$\Delta\rho =$	+ 0.005	+ 0.006			

Σ. 1350.

$\alpha = 9^h\ 23^m.9 \quad \delta = 67°\ 21' \quad$ (7 and 7.8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.288	9.9	67.05	10.53	3	383	
7.318	10.6	66.7	10.65	2	383	
7.337	10.3	66.3	10.55	2	383	
7.370	12.5	65.5	10.64	2	383	
7.375	13.9	66.3	10.66	2	383	Images diffuse.
1877.378	14.2	66.4	10.66	3	383	Thin clouds.
1880.044	5.2	247.7	10.52	3	383	
0.058	3.3	66.3	10.57	2	383	
0.064	4.5	68.0	10.67	2	383	
0.066	4.6	67.5	10.63	2	606	

7 Leonis.

$\alpha = 9^h\ 29^m.1 \quad \delta = 14°\ 56' \quad$ (5.6 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.263	9.4	79.43	41.27	2	383	
7.269	8.4	79.53	41.16	2	383	
7.280	10.6	79.84	41.24	3	383	
7.288	10.4	79.90	41.24	2	606	
7.296	10.2	79.75	41.31	3	383	
7.312	10.3	79.85	41.37	3	383	
7.315	10.6	79.86	41.57	2	383	Through clouds.
7.318	9.5	79.74	41.29	2	383	
	$\Delta\rho =$	+ 0.002	+ 0.012			

Σ. 1495.

$\alpha = 10^h\ 52^m.1$ $\delta = 59°\ 35'$ (6 and 8.9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1877.318	10.9	38.00	34.56	2	383	Images blurred.
7.337	11.4	38.30	34.67	2	383	
7.370	12.8	37.62	34.70	2	383	
7.376	14.3	37.48	34.89	2	383	
7.378	14.5	37.62	34.78	3	383	
7.381	13.6	37.70	34.78	2	383	
	$\Delta\rho =$	+ 0.012	+ 0.010			

Σ. 1603.

α $12^h\ 1\ .9$ $\delta = 56°\ 10'$ (7 and 7.8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.370	13.3	81.62	22.48	2	383	
7.376	14.6	80.78	22.49	2	383	
7.378	14.9	81.45	22.44	3	383	
7.381	13.9	81.82	22.32	2	383	
7.384	13.2	81.42	22.59	2	383	Through clouds.
7.395	14.6	81.38	22.33	2	383	Telescope shaken by wind.
	$\Delta\rho =$	+ 0.009	+ 0.007			

Σ. 1685.

$\alpha = 12^h\ 45^m.7$ $\delta = 19°\ 51'$ (7 and 7.8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.337	12.2	201.55	16.02	2	383	
7.370	11.9	201.0	16.03	2	383	
7.376	15.5	200.8	16.06	2	383	
7.378	15.7	200.65	16.25	3	383	
7.381	14.8	201.3	16.16	2	383	
7.384	14.1	200.2	16.25	3	383	
	$\Delta\rho =$	0.000	+ 0.007			

ι Bootis.

$\alpha = 14^h\ 11^m.7$ $\delta = 51°\ 57'$ (5 and 7.8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.376	15.0	32.72	38.30	3	383	
7.378	15.3	32.88	38.48	3	383	
7.381	14.4	32.80	38.31	2	383	
7.384	13.6	32.78	38.39	3	383	
7.397	14.6	33.08	38.37	2	383	
7.408	11.9	33.18	38.45	2	383	
	$\Delta\rho =$	+ 0.002	+ 0.011			

Σ. 2034.

$\alpha = 16^h\ 4^m.2 \qquad \delta = 83°\ 59'$ (7.8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1876.795	20.1	118.6	1.25	2	606	
6.798	19.9	120.3	1.30	2	606	Images much blurred.
6.801	19.8	118.3	1.34	3	383	
6.803	19.8	118.6	1.13	3	383	
7.422	15.4	111.5	1.28	2	606	Very faint; haze.
7.452	14.4	115.0	1.04	3	606	
7.460	14.4	114.8	1.19	2	383	
7.518	15.2	112.7	1.44	2	383	Images blurred.
7.532	15.4	113.8	1.29	2	383	
8.849	21.6	116.4	1.27	3	383	
8.854	21.7	114.8	1.34	2	383	Images blurred.
8.857	21.8	114.1	1.17	3	383	
8.860	21.1	115.9	1.23	3	383	
9.470	15.0	113.5	1.40	3	606	
9.543	16.6	114.3	1.34	2	606	
9.546	16.5	114.4	1.29	3	606	
9.549	16.6	114.2	1.29	3	606	

$\nu^1\ \nu^2$ Draconis.

$\alpha = 17^h\ 29^m.8 \qquad \delta = 55°\ 15'$ (4.5 and 4.5).

1876.795	19.6	312.47	61.96	3	383	
6.798	19.5	312.50	61.84	3	383	
6.801	19.4	312.50	61.85	3	383	
6.803	19.5	312.50	61.84	3	383	
7.417	15.8	312.35	62.07	2	383	Clouds.
7.422	15.0	312.28	61.98	4	383	
7.428	16.0	312.37	61.87	2	383	
7.447	15.7	312.45	61.98	3	383	
	$\Delta\rho =$	+ 0°.005	+ 0″.020			

Σ. 2326.

$\alpha = 18^h\ 17^m.5 \qquad \delta = 81°\ 27'$ (7.8 and 8.9).

1876.795	20.5	199.2	15.93	3	383	
6.798	20.3	199.3	15.97	3	383	
6.801	20.1	200.0	15.95	3	383	
6.803	20.1	200.1	. .	2	383	Thin clouds.
6.809	20.0	199.7	15.80	3	383	
7.422	15.8	198.6	15.94	3	606	
7.428	16.4	199.3	16.02	3	383	
7.452	14.8	198.4	15.91	2	606	
7.460	14.8	198.5	15.84	3	383	
	$\Delta\rho =$	− 0.005	+ 0.007			

O. Σ. 353.

$\alpha = 18^h\ 22^m.6 \qquad \delta = 71°\ 16' \qquad$ (5 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1876.809	20.3	54.4	0.41	3	888	
6.825	19.9	53.8	0.44	3	888	
6.836	20.1	53.1	0.43	2	888	
9.470	17.0	*51.0	0.53	2	888	Images blurred.
9.697	18.1	56.4	0.32	3	888	
9.699	18.2	50.4	0.34	2	888	
9.708	18.0	48.9	0.36	2	888	
9.713	18.0	49.6	0.33	3	888	

O. Σ. 363.

$\alpha = 18^h\ 43^m.5 \qquad \delta = 77°\ 34' \qquad$ (7 and 7).

1876.809	20.6	23.1	0.39	3	888	
6.817	20.2	21.0	0.36	2	888	
6.825	20.2	19.1	0.43	3	888	
6.836	20.3	21.1	0.43	2	888	
9.470	17.3	206.5	0.32	2	888	
9.697	18.3	19.6	0.37	3	888	
9.699	18.4	201.3	0.45	2	888	
9.708	18.2	205.5	0.45	2	888	
9.713	18.3	206.6	0.41	2	888	

β Lyræ.

$\alpha = 18^h\ 45^m.5 \qquad \delta = 33°\ 13' \qquad$ (3 and 6.7)

1876.655	18.3	148.97	45.87	2	383	Face north.
6.658	18.2	149.09	45.87	2	383	Face north.
6.661	17.6	149.29	45.80	2	383	Face south.
6.664	18.2	149.15	45.75	3	383	Face south.
6.669	17.9	149.31	45.86	3	606	Face north.
6.675	18.2	149.16	45.91	2	606	Face north.
6.680	18.1	149.32	45.80	2	606	Face south.
6.710	18.2	149.16	45.82	2	606	Face south; faint through clouds.
9.543	18.0	149.10	45.80	2	606	Face south.
9.546	18.0	148.91	45.83	2	383	Face east.
9.584	18.6	149.08	45.80	2	606	Face south.
9.587	18.5	149.12	45.98	3	383	Face north.
	$\Delta\rho =$	− 0.011	+ 0.012			

Σ. 2452.

$\alpha = 18^h\ 57^m.8$ $\delta = 75°\ 37'$ (6.7 and 7.8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1876.781	19.3	218.5	5.55	2	383	
6.784	19.3	216.9	5.76	2	383	
6.787	19.3	217.8	5.71	3	383	
6.798	20.6	219.7	5.82	2	383	
6.801	20.6	221.3	5.64	3	383	
7.452	15.4	218.2	5.84	2	383	Haze; stars faint.
7.460	15.2	219.1	5.69	2	383	
7.518	15.6	218.7	5.72	2	383	
9.749	19.0	217.9	5.64	3	606	
9.752	19.0	218.1	5.65	2	383	

Σ. 2571.

$\alpha = 19^h\ 35^m.3$ $\delta = 78°\ 0'$ (7.8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.749	19.3	22.7	11.49	4	383	
6.760	19.4	21.7	11.35	2	383	Images unsteady.
6.781	19.6	21.9	11.36	3	383	
6.784	19.6	21.8	11.44	2	383	
7.460	15.6	21.0	11.36	3	383	
7.518	16.0	20.9	11.41	2	383	
7.532	15.8	20.9	11.46	2	383	
7.534	15.8	20.7	11.33	2	383	
9.697	18.7	21.9	11.38	2	606	
9.699	18.6	22.5	11.40	3	606	
9.708	18.5	22.0	11.39	2	606	

ε Draconis.

$\alpha = 19^h\ 48^m.6$ $\delta = 69°\ 57'$ (4 and 7.8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.746	19.3	4.3	3.01	3	383	
6.749	19.7	2.4	2.97	3	383	
6.760	19.6	1.1	3.00	2	383	
6.779	19.8	359.7	3.15	2	383	Images blurred.
6.781	19.8	0.0	3.04	3	383	
7.460	16.0	2.6	3.00	2	383	Blazing images.
7.518	16.3	1.6	2.74	2	383	
7.532	16.1	357.2	2.97	2	383	Images blurred.
7.534	15.5	4.0	2.89	2	383	
9.697	19.0	2.7	3.03	3	606	
9.699	18.8	4.3	3.09	3	606	
9.708	18.8	1.8	3.02	2	606	
9.713	18.6	3.9	3.03	2	383	

κ Cephei.

$\alpha = 20^h\ 13^m.1 \qquad \delta = 77^\circ\ 20' \qquad$ (4 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1876.746	19.7	120.5	7.54	3	383	
6.749	20.0	121.8	7.49	3	383	
6.760	20.0	121.5	7.54	2	383	
6.779	20.2	121.1	7.53	2	383	
7.460	16.4	126.0	7.40	2	383	
7.518	16.7	123.4	7.48	2	383	
7.532	16.4	122.5	7.43	2	383	
7.534	16.1	125.0	7.40	2	383	
9.749	19.5	122.2	7.42	3	606	
9.752	19.3	120.7	7.43	3	383	

𝕮 .

$\alpha = 21^h\ 18^m.0 \qquad \delta = 78^\circ\ 4' \qquad$ (7.8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.746	20.1	43.57	25.13	3	383	
6.749	20.3	43.52	25.13	3	383	
6.760	20.4	43.52	25.21	2	383	
6.779	20.5	43.15	25.04	2	383	Images very unsteady.
7.537	16.1	42.95	25.22	2	383	Very unsteady.
8.961	2.2	43.55	25.36	2	383	
8.969	1.2	43.38	25.09	3	383	
8.972	0.1	43.20	24.99	4	383	
	$\Delta\rho =$	+ 0.005	+ 0.008			

Σ. 2801.

$\alpha = 21^h\ 22^m.2 \qquad \delta = 79^\circ\ 49' \qquad$ (7.8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.749	20.6	269.9	1.61	3	383	
6.760	20.6	272.4	1.73	2	383	
6.781	20.4	272.9	1.73	3	383	
6.784	20.1	273.1	1.76	2	383	
8.807	21.1	271.0	1.62	2	606	
8.818	20.6	272.1	1.52	3	606	
9.697	20.1	273.6	1.69	2	606	
9.699	20.3	276.1	1.76	2	606	Clouds.
9.719	20.5	274.4	1.55	3	606	
9.853	23.1	271.6	1.46	3	606	
9.861	22.8	270.3	1.72	3	606	
9.864	22.5	272.2	1.77	2	606	

β Cephei.

$\alpha = 21^h\ 27^m.0 \quad \delta = 70^\circ\ 1'$ (3 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1876.760	21.0	250.7	13.64	3	383	
6.781	20.7	250.0	13.47	3	383	
6.784	20.4	251.1	13.49	3	383	
6.787	20.6	250.1	13.66	3	383	
8.961	2.7	250.4	13.53	3	383	
8.969	1.5	252.3	13.62	2	383	
8.972	0.4	251.1	13.50	3	383	
9.040	2.3	250.3	13.24	2	383	
9.051	1.5	250.4	13.58	3	383	
9.057	2.1	250.1	13.49	2	383	

Σ. 2893.

$\alpha = 22^h\ 10^m.6 \quad \delta = 72^\circ\ 41'$ (5.6 and 7.8).

1876.781	21.1	347.92	28.88	3	383	
6.798	21.0	347.85	28.95	2	383	
6.801	20.8	348.03	28.92	3	383	
6.809	21.1	348.08	28.83	4	383	
8.961	1.8	348.60	28.95	2	383	
8.969	1.9	348.20	29.01	2	383	
8.972	1.4	348.35	29.09	2	383	Through clouds.
	$\Delta\rho$	+ 0.008	+ 0.009			

Σ. 2924.

$\alpha = 22^h\ 29^m.4 \quad \delta = 69^\circ\ 17'$ (7 and 7.8).

1876.825	21.2	267.7	0.85	3	888	
6.836	20.7	262.5	0.80	2	606	
8.772	20.4	265.9	0.78	3	606	
8.783	19.6	264.4	0.82	2	606	Images blurred.
8.788	19.9	263.5	0.76	3	606	
8.791	20.0	264.3	0.71	3	606	
9.699	21.4	266.6	1.07	2	606	Images indistinct.
9.719	20.8	265.5	0.90	2	888	
9.730	21.4	268.4	0.87	3	606	
9.738	18.9	265.5	0.83	3	606	
9.738	20.9	267.3	0.87	3	606	
9.741	19.5	264.0	0.78	2	606	
9.741	21.1	267.5	0.86	3	606	

Σ. 2923.

$\alpha = 22^h\ 29^m.7 \qquad \delta = 69^\circ\ 44' \qquad$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1876.825	21.4	47.3	9.64	2	383	
6.836	20.9	46.5	9.47	3	383	
6.772	20.6	46.3	9.43	3	606	
8.783	19.9	46.2	9.43	2	606	
8.788	20.2	45.8	9.59	3	606	
8.791	20.3	46.1	9.59	3	606	
9.719	21.0	46.9	9.70	3	606	
9.730	21.6	47.3	9.47	3	606	
9.738	19.2	46.1	9.61	3	606	
9.741	19.8	46.4	9.56	2	606	

O. Σ. 481.

$\alpha = 22^h\ 41^m.8 \qquad \delta = 77^\circ\ 52' \qquad$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.825	21.7	268.0	2.49	2	383	
6.836	21.3	269.6	2.31	3	383	
8.772	20.9	270.5	2.39	3	606	
8.783	20.3	267.9	2.23	2	383	Images blurred.
8.788	20.5	268.2	2.37	3	606	
8.791	20.8	271.5	2.39	2	606	Hazy.
8.961	3.0	269.9	2.32	3	383	
8.969	2.2	271.7	2.52	2	383	
9.051	1.8	270.6	2.32	3	383	
9.057	2.3	270.0	2.32	2	383	

O. Σ. 489.

$\alpha = 23^h\ 3^m.9 \qquad \delta = 74^\circ\ 43' \qquad$ (5 and 7.8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.772	21.3	24.8	1.15	2	888	
8.788	20.7	27.5	1.16	2	888	Images blurred.
8.805	21.0	26.1	1.20	3	606	
8.807	20.2	30.1	1.21	3	606	
8.818	20.2	28.0	1.06	3	606	
8.821	20.1	31.7	1.32	2	606	
9.730	21.8	24.1	1.21	3	606	
9.738	19.5	30.8	1.30	2	606	
9.741	20.1	29.6	1.36	2	606	
1879.749	19.8	28.0	1.17	2	606	
1880.044	2.1	25.2	1.03	2	606	
.058	2.0	25.8	1.16	2	606	
.064	2.2	27.4	1.25	2	606	Images blurred.
.066	2.5	26.5	1.24	2	606	Images blurred.

Σ. 3051.

$\alpha = 23^h\ 56^m.3$ $\delta = 79°\ 35'$ (7.8 and 9.10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	″				
1878.772	21.8	23.4	16.99	3	606	
8.783	20.7	22.4	16.79	2	383	
8.788	21.0	22.1	16.95	2	606	Images blurred.
8.791	21.5	22.8	16.97	2	606	Hazy.
8.794	21.6	23.7	16.92	2	303	
8.805	21.4	22.8	16.92	3	606	
9.730	22.2	23.4	16.97	3	606	
9.738	20.3	22.6	16.90	2	606	
9.741	20.5	22.6	16.83	3	606	
	$\Delta\rho =$	− 0.017	+ 0 008			

The preceding observations were made in an average condition of the images, as will be seen from the numbers given in the column Wt. But probably in my earlier observations these numbers were estimated too low, and where 2 and 3 are given we should have 3 and 4. In deducing the final results I have taken the simple means without regard to the weights, or to the remarks, since it seems best that the varying conditions of the images from night to night should be allowed to exert their proper influence. It is sometimes surprising to see how observations made when the images are very unsteady agree with the mean result Probably this is caused by the fact that the observer in this case gives more time to the observation, and in this way gets nearly the mean position of the vibrating images. A few cases occur where there seems to be a mistake in the reading, but all the observations are given as they were made, and no observation has been rejected.

It will be noticed that in the observations of some of the stars, Σ. 191 and Σ. 2034, there seems to be a systematic error in the observed angles of position; but in computing the probable errors no regard has been paid to this fact, and the given probable errors of the angles are therefore a little too great.

In the case of β Lyræ, which passes near our zenith, I have changed my position from face north to face south, in order to see if any difference was produced in the measures by such a change, but there appears to be none.

The star Σ. 2034 has been one of the most troublesome to observe, because the images were frequently confused and indistinct The condition of things has often been as follows: I would be observing stars near the zenith, the images being tolerably good; on turning the telescope down toward the north to the star Σ. 2034, the images at first would be fair, but after a few minutes, and before an observation could be made, the images would become so bad that an observation was impossible, the stars being simply a confused mass of light. This condition was probably produced by the cool north wind blowing against the warm object-glass and disturbing its figure. Our large objective is very sensitive to changes of temperature, and will not perform

well so long as these changes are rapid. The star O. Σ. 489 is another difficult object to observe.

In the following table are given the results of the preceding observations: the mean date of the observations, the mean values of the angles of position and the distances, and their probable errors. In the last columns are given the probable errors of a single observed angle and distance, and the number of observations.

The corrections for differential refraction, denoted by $\Delta\rho$, have been applied to the mean results.

Results.

Star.	Date.	p.	r_m	s.	r_m	r_1p.	r_1s.	No. of obs.
		°	′ ±	″	″ ±	″ ±	″ ±	
Σ. 170	1879.071	246.75	0.0078	3.203	0.0219	0.027	0.076	12
Σ. 191	1879.277	190.36	0.0446	5.627	0.0145	0.184	0.060	17
σ. 244	1877.282	21.162	0.0292	48.348	0.0232	0.092	0.070	10
Σ. 1169	1877.291	11.324	0.0234	20.930	0.0207	0.057	0.051	6
Σ. 1321	1877.974	59.172	0.0208	19.635	0.0188	0.062	0.056	9
Σ. 1350	1878.130	66.775	0.0306	10.608	0.0125	0.097	0.040	10
σ. 350	1877.293	79.740	0.0292	41.318	0.0293	0.083	0.083	8
Σ. 1495	1877.360	37.799	0.0510	34.740	0.0312	0.125	0.076	6
Σ. 1603	1877.381	81.421	0.0377	22.449	0.0284	0.092	0.069	6
Σ. 1685	1877.371	200.917	0.0372	16.135	0.0293	0.091	0.072	6
σ. 455	1877.387	32.909	0.0338	38.394	0.0200	0.083	0.049	6
Σ. 2034	1878.124	115.36	0.0086	1.270	0.0160	0.035	0.066	17
σ. 549	1877.114	312.433	0.0216	61.944	0.0204	0.061	0.058	8
Σ. 2326	1877.085	199.228	0.0396	15.927	0.0169	0.119	0.048	9
O. Σ. 353	1878.595	52.20	0.0043	0.395	0.0171	0.012	0.048	8
O. Σ. 363	1878.397	22.64	0.0046	0.401	0.0100	0.014	0.030	9
σ. 593	1877.636	149.128	0.0198	45.853	0.0120	0.069	0.042	12
Σ. 2452	1877.588	218.62	0.0257	5.702	0.0189	0.081	0.060	10
Σ. 2571	1877.838	21.64	0.0273	11.397	0.0100	0.090	0.033	11
Σ. 2603	1877.898	1.97	0.0205	2.995	0.0183	0.074	0.066	13
Σ. 2675	1877.658	122.47	0.0508	7.466	0.0122	0.161	0.038	10
Σ. 2796	1877.684	43.360	0.0240	25.154	0.0277	0.068	0.078	8
Σ. 2801	1878.616	272.47	0.0098	1.659	0.0203	0.034	0.070	12
Σ. 2806	1878.116	250.65	0.0352	13.522	0.0257	0.111	0.081	10
Σ. 2893	1877.727	348.155	0.0336	28.956	0.0217	0.089	0.057	7
Σ. 2924	1878.992	265.62	0.0050	0.838	0.0163	0.018	0.059	13
Σ. 2923	1878.772	46.49	0.0183	9.549	0.0200	0.058	0.063	10
O. Σ. 481	1878.483	269.79	0.0122	2.366	0.0186	0.038	0.059	10
O. Σ. 489	1879.429	27.54	0.0088	1.201	0.0165	0.033	0.062	14
Σ. 3051	1879.105	22.850	0.0350	16.924	0.0151	0.105	0.046	9

The whole number of my observations of these stars is 296. The mean distance of the thirty stars is 17″.16; and the average values of the probable errors of a single distance and of a single angle are as follows:

Probable error of a single distance $= \pm$ 0″.059
Probable error of a single angle $= \pm$ 0″.075

The further discussion of these observations must be deferred until the observations of other observers are published. It is my intention to continue the observations of a few of these stars, especially those of which the components are of very unequal magnitudes, and where the observations are difficult and appear to be subject to large systematic errors, such as Σ. 191, ε Draconis, and $O. \Sigma$. 489.

§ 6.

As it is interesting to apply a geometrical test to observations, in addition to the preceding work, I have observed the multiple stars Σ. 2703, Σ. 311, and the stars in the Trapezium of Orion. In the case of three stars, A, B, C, if we take the origin of co-ordinates at A and observe the angles of position and the distances of B and C only, then these quantities are independent, and we may put their differentials equal to zero. But if we observe also the angle of position and the distance between B and C, we have obtained more quantities than the geometrical conditions require, and must adjust the parts of the triangle by the method of least squares. The following is the method of W. STRUVE, *Mensuræ Micrometricæ*, p. L. From the observations we make

$$\alpha = s \cos p \qquad \beta = s \sin p$$
$$\alpha' = s' \cos p' \qquad \beta' = s' \sin p'$$

and the true values of these co-ordinates will be,

$$x = \alpha + \xi \qquad y = \beta + \eta$$
$$x' = \alpha' + \xi' \qquad y' = \beta' + \eta'$$

ξ, ξ', η, and η' being corrections to be found from the equations of condition. The geometrical relations give us the six equations:

$$x^2 + y^2 = s^2 \qquad (1) \qquad\qquad \frac{y}{x} = \text{tang } p \qquad (4)$$

$$x'^2 + y'^2 = s'^2 \qquad (2) \qquad\qquad \frac{y'}{x'} = \text{tang } p' \qquad (5)$$

$$(x' - x)^2 + (y' - y)^2 = s''^2 \qquad (3) \qquad\qquad \frac{y' - y}{x' - x} = \text{tang } p''. \qquad (6)$$

If we make

$$\text{tang } q'' = \frac{\beta' - \beta}{\alpha' - \alpha} \qquad \varepsilon'' = \frac{\beta' - \beta}{\sin q''} = \frac{\alpha' - \alpha}{\cos q''},$$

and put

$$ds'' = s'' - \varepsilon'' \qquad \pi'' = q'' - p'',$$

the differentiation of the six equations will give the following equations of condition for the triangle:

$$\begin{array}{l}
\cos p.\ \ \xi + \sin p.\ \ \eta = o. \\
\cos p.'\ \ \xi' + \sin p.'\ \ \eta' = o. \\
\cos p.''\ \ \xi - \cos p.''\ \ \xi' + \sin p.''\ \eta - \sin p.''\ \eta' + s'' - \varepsilon'' = o. \\
\sin p.\ \ \xi - \cos p.\ \ \eta = o. \\
\sin p.'\ \ \xi' - \cos p.'\ \ \eta' = o. \\
\sin p.''\ \ \xi - \sin p.''\ \ \xi' - \cos p''\ \eta + \cos p.''\ \eta' + \varepsilon'' \sin \pi'' = o.
\end{array}$$

In the case of a quadrilateral, we shall have, if we put

$$\alpha'' = s''\ \cos p'' \qquad \beta'' = s''\ \sin p''$$

and

$$x'' = \alpha'' + \xi'' \qquad y'' = \beta'' + \eta'';$$

$$\operatorname{tang} q''' = \frac{\beta' - \beta}{\alpha' - \alpha} \qquad \varepsilon''' = \frac{\beta' - \beta}{\sin q'''} = \frac{\alpha' - \alpha}{\cos q'''}$$

$$\operatorname{tang} q^{iv} = \frac{\beta'' - \beta}{\alpha'' - \alpha} \qquad \varepsilon^{iv} = \frac{\beta'' - \beta}{\sin q^{iv}} = \frac{\alpha'' - \alpha}{\cos q^{iv}}$$

$$\operatorname{tang} q^{v} = \frac{\beta'' - \beta'}{\alpha'' - \alpha'} \qquad \varepsilon^{v} = \frac{\beta'' - \beta'}{\sin q^{v}} = \frac{\alpha'' - \alpha'}{\cos q^{v}},$$

$$q''' - p''' = \pi''' \qquad q^{iv} - p^{iv} = \pi^{iv} \qquad q^{v} - p^{v} = \pi^{v},$$

and the equations of condition are:

$$\begin{array}{l}
\cos p.\ \ \xi + \sin p.\ \ \eta = o. \\
\cos p.'\ \ \xi' + \sin p.'\ \ \eta' = o. \\
\cos p.''\ \ \xi'' + \sin p.''\ \ \eta'' = o. \\
\cos p.'''\ \ \xi - \cos p.'''\ \xi' + \sin p.'''\ \eta - \sin p.'''\ \eta' + s''' - \varepsilon''' = o. \\
\cos p.^{iv}\ \ \xi - \cos p.^{iv}\ \xi'' + \sin p.^{iv}\ \eta - \sin p.^{iv}\ \eta'' + s^{iv} - \varepsilon^{iv} = o. \\
\cos p.^{v}\ \ \xi' - \cos p.^{v}\ \xi'' + \sin p.^{v}\ \eta' - \sin p.^{v}\ \eta'' + s^{v} - \varepsilon^{v} = o. \\
\sin p.\ \ \xi - \cos p.\ \ \eta = o. \\
\sin p.'\ \ \xi' - \cos p.'\ \ \eta' = o. \\
\sin p.''\ \ \xi'' - \cos p.''\ \ \eta'' = o. \\
\sin p.'''\ \ \xi - \sin p.'''\ \xi' - \cos p.'''\ \eta + \cos p.'''\ \eta' + \varepsilon'''\ \sin \pi''' = o. \\
\sin p.^{iv}\ \ \xi - \sin p.^{iv}\ \xi'' - \cos p.^{iv}\ \eta + \cos p.^{iv}\ \eta'' + \varepsilon^{iv}\ \sin \pi^{iv} = o. \\
\sin p.^{v}\ \ \xi - \sin p.^{v}\ \xi'' - \cos p.^{v}\ \eta' + \cos p.^{v}\ \eta'' + \varepsilon^{v}\ \sin \pi^{v} = o.
\end{array}$$

Generally the probable errors of the distances and of the angles will be found by comparing the observations among themselves, and the values of these errors will give the weights of the equations of condition. The equations depending on the distances or on the angles, being multiplied by the ratio of the probable errors, the system of equations will be ready for solution, which may be made according to the

common method of least squares. If, however, the probable errors of the distances and the angles are nearly equal, we may give the weight unity to all the equations, and then the solution becomes very simple, since the co-efficients consist of sines and cosines symmetrically placed. In this case the solution for the triangle has been given by W. STRUVE, *Mensuræ Micrometricæ*, p LII, and it is easy to extend the solution to the quadrilateral. Thus, in this case, if we make for the triangle,

$$\begin{aligned} \varkappa_2 &= \cos p.'' \,(s'' - \varepsilon'') + \sin p.'' \,\varepsilon'' \sin \pi'', \\ \lambda_2 &= \sin p.'' \,(s'' - \varepsilon'') - \cos p.'' \,\varepsilon'' \sin \pi'', \end{aligned}$$

the normal equations are

$$\begin{aligned} +2\xi + 0\eta - \xi' + 0\eta' + \varkappa_2 &= 0 \\ +2\eta + 0\xi' - \eta' + \lambda_2 &= 0 \\ +2\xi' + 0\eta' - \varkappa_2 &= 0 \\ +2\eta' - \lambda_2 &= 0 \end{aligned}$$

Hence we have the equations

$$\xi + \xi' = 0 \qquad \eta + \eta' = 0,$$

and the values of the unknown quantities are

$$\xi = -\frac{\varkappa_2}{3} \qquad \eta = -\frac{\lambda_2}{3},$$

$$\xi' = +\frac{\varkappa_2}{3} \qquad \eta' = +\frac{\lambda_2}{3}.$$

For the quadrilateral we make

$$\begin{aligned} \varkappa_3 &= \cos p.''' \,(s''' - \varepsilon''') + \sin p.''' \,\varepsilon''' \sin \pi''' & \lambda_3 &= \sin p.''' \,(s''' - \varepsilon''') - \cos p.''' \,\varepsilon''' \sin \pi \;, \\ \varkappa_4 &= \cos p.^{\text{iv}} \,(s^{\text{iv}} - \varepsilon^{\text{iv}}) + \sin p.^{\text{iv}} \,\varepsilon^{\text{iv}} \sin \pi^{\text{iv}} & \lambda_4 &= \sin p.^{\text{iv}} \,(s^{\text{iv}} - \varepsilon^{\text{iv}}) - \cos p.^{\text{iv}} \,\varepsilon^{\text{iv}} \sin \pi^{\text{iv}}, \\ \varkappa_5 &= \cos p.^{\text{v}} \,(s^{\text{v}} - \varepsilon^{\text{v}}) + \sin p.^{\text{v}} \,\varepsilon^{\text{v}} \sin \pi^{\text{v}} & \lambda_5 &= \sin p.^{\text{v}} \,(s^{\text{v}} - \varepsilon^{\text{v}}) - \cos p.^{\text{v}} \,\varepsilon^{\text{v}} \sin \pi^{\text{v}}, \end{aligned}$$

and the normal equations are

$$\begin{aligned} +3\xi + 0\eta - \xi' + 0\eta' - \xi'' + 0\eta'' + \varkappa_3 + \varkappa_4 &= 0 \\ +3\eta + 0\xi' - \eta' + 0\xi'' - \eta'' + \lambda_3 + \lambda_4 &= 0 \\ +3\xi' + 0\eta' - \xi'' + 0\eta'' - \varkappa_3 + \varkappa_5 &= 0 \\ +3\eta' + 0\xi'' - \eta'' - \lambda_3 + \lambda_5 &= 0 \\ +3\xi'' + 0\eta'' - \varkappa_4 - \varkappa_5 &= 0 \\ +3\eta'' - \lambda_4 - \lambda_5 &= 0 \end{aligned}$$

Hence we have

$$\begin{aligned} \xi + \xi' + \xi'' &= 0 \\ \eta + \eta' + \eta'' &= 0, \end{aligned}$$

and the values of the unknown quantities are

$$\xi = \frac{-\varkappa_3 - \varkappa_4}{4} \qquad \eta = \frac{-\lambda_3 - \lambda_4}{4}$$

$$\xi' = \frac{+\varkappa_3 - \varkappa_5}{4} \qquad \eta' = \frac{+\lambda_3 - \lambda_5}{4}$$

$$\xi'' = \frac{+\varkappa_4 + \varkappa_5}{4} \qquad \eta'' = \frac{+\lambda_4 + \lambda_5}{4}$$

The following are my observations and reductions of the multiple stars. The corrections for differential refraction are denoted by $\Delta\rho$:

Σ. 2703. *A* and *B*.

$\alpha = 20^h\ 31^m\ 2$ $\delta = 14°\ 19'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.678	21.0	110.35	25.40	2	383	
9.680	20.6	110.10	25.46	2	606	
9.683	19.5	110.77	25.37	3	606	
9.688	19.9	110.15	25.27	2	383	
9.691	20.7	110.32	25.36	2	383	
9.694	20.0	110.48	25.29	3	606	
9.697	20.4	110.38	25.29	2	383	
1879.687		110.364	25.349			
	$\Delta\rho$	+ 0.002	+ 0.007			
		110.366	25.356			

A and *C*. (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.678	21.1	217.13	58.03	2	383	
9.680	20.9	216.90	57.97	2	606	
9.683	19.7	216.90	57.90	2	606	
9.688	20.3	217.12	58.10	2	383	
9.694	20.2	217.05	57.99	3	606	
9.697	20.6	217.02	58.02	2	383	
1879.687		217.020	58.002			
	$\Delta\rho=$	− 0.002	+ 0.018			
		217.018	58.020			

B and *C*. (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.678	21.3	237.73	69 71	2	383	
9.680	21.0	237.55	69 79	2	606	
9.683	20.0	237.70	69.71	2	606	
9.688	20 5	237.55	69.63	2	383	
9 694	20.4	237.42	69.58	3	606	
9.697	20.8	237.45	69.65	2	383	
1879.687		237.567	69.678			
	$\Delta\rho =$	− 0.002	+ 0.021			
		237.565	69.699			

$$\alpha = - \ 8''.8242 \qquad \beta = + 23''.7706.$$
$$\alpha' = - 46''.3256 \qquad \beta' = - 34''.9317.$$

Computing the probable errors of a single observation from the agreement of these observations among themselves, we have,

for a single distance, $r = \pm 0''.047$;
for a single angle, $r = \pm 0''.079$;

this last error corresponding to the mean distance of $51''.03$. The equations of condition are as follows:

ξ	η	ξ'	η'	n		Residuals.
						″
9.5416*n*	9.9720	. .	. .	. .	= 0	+ 0.025
. .	. .	9.9022*n*	9.7796*n*	. .	= 0	+ 0.002
9.7311*n*	9.9257*n*	9.7311	9.9257	8.5911	= 0	+ 0.010
9.9720	9.5416	. .	. .	. .	= 0	− 0.010
. .	. .	9.7796*n*	9.9022	. .	= 0	− 0.044
9.9257*n*	9.7311	9.9257	9.7311*n*	9.2216*n*	= 0	− 0.040

Assuming the weight of an equation depending on the distance as unity we have to multiply the equations derived from the angles by the factor 0.595. The normal equations are,

$$\begin{array}{rrrrrl}
+0.9736\,\xi & +0.0823\,\eta & -0.5413\,\xi' & -0.2931\,\eta' & +0.02869 & =0 \\
 & +1.7347 & -0.2931 & -0.8128 & -0.06462 & =0 \\
 & & +1.3070 & +0.6035 & -0.02869 & =0 \\
 & & & +1.4008 & +0.06462 & =0
\end{array}$$

The solution of these equations gives,

$$\xi = -0''.0249; \qquad \eta = +0''.0178$$
$$\xi' = +0''.0431; \qquad \eta' = -0''.0596$$

From the elimination we have $[nn.4] = 0.00439$; and from the substitution in the equations of condition we have $[nn.4] = 0.00437$. The probable error of an equa-

tion of weight unity is therefore $\pm$ 0''.032, and the adjustment is satisfactory. The values of the adjusted angles and distances are as follows:

$$p = 110^\circ.405 \qquad s = 25''.381$$
$$p' = 217\ .091 \qquad s' = 58\ .021$$
$$p'' = 237\ .510 \qquad s'' = 69\ .687$$

Epoch, 1879.687.

Σ. 311. *A* and *B*.

$\alpha = 2^h\ 42^m.3 \qquad \delta = 17^\circ\ 0'$ (5 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.918	1.7	122.0	3.23	3	606	
9.921	1.7	122.0	3.36	3	383	
9.935	0.4	120.2	3.42	2	383	
9.938	1.8	124.0	3.18	2	383	Hazy; clouds.
9.948	1.7	123.1	2.94	3	383	
9.957	1.5	124.4	3.54	2	383	
9.965	0.6	121.6	3.37	3	606	
1879.940		122.47	3.291			

A and *C*. (5 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.918	1.9	109.58	25.10	2	606	
9.921	1.9	110.30	25.13	3	383	
9.935	0.6	109.68	25.30	3	383	
9.948	1.8	109.68	25.21	2	383	
9.957	1.7	110.02	25.14	2	383	
9.965	0.9	110.12	25.15	3	606	
1879.941		109.90	25.172			
	$\Delta\rho =$	0.00	+ 0.008			
		109.90	25.180			

B and *C*. (9 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.918	2.0	107.70	21.55	2	606	Image blurred.
9.921	2.0	107.68	21.81	3	383	
9.935	0.9	107.78	21.72	2	383	Hazy.
9.948	2.1	108.40	21.91	3	383	
9.957	1.9	107.68	21.60	2	383	
9.965	1.1	107.75	21.91	3	606	
1879.941		107.83	21.750			
	$\Delta\rho =$	0.00	+ 0.007			
		107.83	21.757			

$$\alpha = -1''.7668 \qquad \beta = +2''.7765$$
$$\alpha' = -8''.5708 \qquad \beta' = +23''.6767$$

The probable error of a single observation is

for a single distance - - $r = \pm 0''.072$
for a single angle - - - $r = \pm 0''.094$

at the mean distance $16''.74$. Since the stars in this group are difficult to observe, and the probable errors of the distances and the angles are not very different, I have assumed that all the equations have the weight unity. The equations of condition are:

ξ	η	ξ'	η'	n		Residuals.
						$''$
9.7299n	9.9262	. .	. .	. .	= 0	+ 0.078
. .	. .	9.5320n	9.9733	. .	= 0	− 0.075
9.4860n	9.9786	9.4860	9.9786n	9.3483n	0	− 0.074
9.9262	9.7299	. .	. .	. .	= 0	− 0.006
. .	. .	9.9733	9.5320	. .	= 0	+ 0.023
9.9786	9.4860	9.9786n	9.4860n	8.8865	= 0	+ 0.026

In this case we have

$$\varkappa_2 = +0''.1416 \qquad \lambda_2 = -0''.1887$$

and the values of the unknown quantities are

$$\xi = -0''.0472 \qquad \eta = +0''.0629$$
$$\xi' = +0''.0472 \qquad \eta' = -0''.0629$$

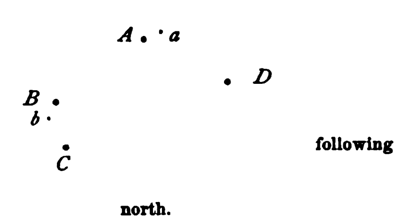
The sum of the squares of the residuals is $0''.01843$, and the probable error of an equation of weight unity is $\pm 0''.065$. This adjustment is also satisfactory.

The values of the adjusted angles and distances are

$$p = 122^\circ.57 \qquad s = 3''.369$$
$$p' = 109.85 \qquad s' = 25.105$$
$$p'' = 107.90 \qquad s'' = 21.831$$

Epoch, 1879.941.

The following are my observations of the multiple star θ' Orionis. I have designated the brightest star of the group by the letter A, and the other stars by letters, as shown in the diagram. The observations of 1877 were made with bright wires in a dark field, and those of 1878 with dark wires in a bright field In 1877 each distance depends on two measurements of the double distance, but in 1878 four measurements of the double distance were made. The field illumination was, however, very unsteady, and it was during these observations of 1878 that I was obliged to change eyes in observing. This fact, together with the unsteadiness of the illumination, will



account for the nearly equal probable errors of the different methods of observation, notwithstanding fewer measurements of the distances were made in 1877 than in 1878. Computing the values of the probable errors of a single observation, we have in 1877:

Probable error of a single distance - - - $r = \pm 0''.061$
Probable error of a single angle - - - $r = \pm 0.057$.

at the mean distance 15''.56.
And in 1878:

Probable error of a single distance - - $r = \pm 0''.051$
Probable error of a single angle - - - $r = \pm 0.069$

These values of the probable errors of the distances and the angles are so nearly equal that I have given the weight unity to all the equations of condition.

θ' **Orionis** = Σ. 748. *A* and *B*.

$\alpha = 5^h\ 29.^m2 \quad \delta = -5°\ 28'.4$ (5 and 7).

Date.	Sid. Time.	*p*	*s*	Wt.	Power.	Remarks.
	h.	°	''			
1877.085	3.3	311.1	13.14	3	383	
7.090	3.7	310.6	12.98	2	383	
7.104	4.0	311.2	13.15	3	383	
7.109	4.0	310.4	13.21	2	383	
7.112	4.4	310.8	13.11	3	383	
7.115	4.6	311.1	13.28	3	383	
1877.103		310.87	13.145			
	$\Delta\rho$ =	+ 0.01	+ 0.008			
		310.88	13.153			

A and *C*. (5 and 8).

Date.	Sid. Time.	*p*	*s*	Wt.	Power.	Remarks.
1877.085	3.6	342.1	16.97	2	383	
7.090	4.1	342.5	16.78	2	383	
7.104	4.2	342.2	16.79	3	383	
7.109	4.3	342.5	16.92	2	383	
7.112	4.6	342.5	16.84	2	383	
7.115	4.8	343.0	16.72	3	383	
7.164	5.1	342.6	16.80	3	383	
7.205	7.0	342.4	16.86	2	383	
1877.123		342.48	16.835			
	$\Delta\rho$ =	0.00	+ 0.010			
		342.48	16.845			

A and *D*. (5 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1877.085	3.8	60.4	13.53	2	383	
7.090	4.5	61.3	13.49	2	383	
7.104	4.5	61.4	13.42	3	383	
7.109	4.5	61.2	13.72	2	383	
7.112	4.9	60.8	13.53	3	383	
7.115	5.0	61.7	13.38	3	383	
1877.103		61.13	13.512			
	$\Delta\rho =$	0.00	+ 0.004			
		61.13	13.516			

A and *a*. (5 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.085	4.2	119.2	4.15	2	383	
7.104	4.7	121.2	3.96	3	383	
7.112	3.8	122.0	4.04	3	383	
7.115	4.2	120.7	3.87	3	383	
1877.104		120.78	4.005			

B and *D*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.129	5.0	95.5	21.62	3	383	
7.164	5.8	95.4	21.49	3	383	
7.172	6.1	95.7	21.76	2	383	
7.192	7.1	95.4	21.74	2	383	
7.205	6.1	95.5	21.67	2	383	
7.219	7.5	95.5	21.72	2	383	
1877.180		95.50	21.667			
	$\Delta\rho =$	0.00	+ 0.006			
		95.50	21.673			

B and *b*. (7 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.085	4.4	351.7	4.10	2	383	
7.104	4.9	352.3	4.29	2	383	
7.112	4.2	351.2	4.21	3	383	
7.115	4.4	351.0	4.24	3	383	
1877.104		351.55	4.210			

C and *B*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1877.118	4.4	214.7	8.76	3	383	
7.126	4.0	213.1	8.70	2	383	
7.129	4.2	214.5	8.78	3	383	
7.164	5.3	212.5	8.77	2	383	
7.172	5.2	212.3	8.84	3	383	
7.192	6.5	213.3	8.77	2	383	
7.205	6.7	213.0	8.56	2	383	
7.219	7.0	213.1	8.66	2	383	
1877.166		213.31	8.730			
	$\Delta\rho =$	− 0.01	+ 0.004			
		213.30	8.734			

C and *D*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.118	5.1	118.8	19.40	3	383	
7.129	4.4	119.1	19.54	3	383	
7.164	5.6	119.3	19.54	3	383	
7.172	5.6	119.3	19.46	2	383	
7.192	6.8	119.1	19.46	2	383	
7.205	6.4	119.4	19.41	2	383	
7.219	7.3	119.3	19.41	2	383	
1877.171		119.19	19.460			
	$\Delta\rho =$	+ 0.01	+ 0.006			
		119.20	19.466			

C and *a*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.118	4.1	155.4	19.93	3	383	
7.129	3.9	155.0	19.95	3	383	
7.164	6.1	154.8	20.12	2	383	
7.192	6.2	154.9	19.93	3	383	
7.219	6.7	154.2	19.72	2	383	
1877.164		154.86	19.930			
	$\Delta\rho =$	0.00	+ 0.007			
		154.86	19.937			

C and *b*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.118	4.8	239.6	6.16	3	383	
7.126	4.3	240.5	6.28	2	383	
7.129	4.7	240.4	6.33	3	383	
7.164	6.3	240.1	6.17	2	383	
7.183	6.4	239.6	. .	4	383	Clouds.
7.192	5.9	240.8	6.25	3	383	
7.219	6.5	238.0	6.19	2	383	
1877.162		239.86	6.230			

A and *B*.

Date.	Sid. Time.	*p*	*s*	Wt.	Power.	Remarks.
	h.	°	″			
1878.101	4.2	310.95	13.23	2	383	
8.103	4.6	310.03	13.31	2	383	
8.142	4.7	311.03	13.20	3	383	
8.161	5.1	311.27	13.06	3	383	
8.163	5.0	311.23	13.23	2	383	
8.166	5.1	310.47	13.19	3	383	
8.177	5.2	310.20	13.17	3	383	
1878.145		310.74	13.199			
	$\Delta\rho=$	+ 0.01	+ 0.006			
		310.75	13.205			

A and *C*.

Date.	Sid. Time.	*p*	*s*	Wt.	Power.	Remarks.
1878.103	5.0	342.15	16.65	2	383	
8.142	5.0	342.73	16.83	3	383	
8.161	5.3	343.37	16.77	3	383	
8.163	5.2	342.70	16.87	3	383	
8.166	5.3	342.05	16.80	3	383	
8.177	5.5	342.33	16.73	3	383	
8.185	5.7	342.50	16.71	3	383	
1878.157		342.55	16.766			
	$\Delta\rho=$	0.00	+ 0.009			
		342.55	16.775			

A and *D*.

Date.	Sid. Time.	*p*	*s*	Wt.	Power.	Remarks.
1878.103	5.4	61.87	13.34	2	383	
8.142	5.3	61.63	13.48	3	383	
8.161	5.5	61.33	13.38	3	383	
8.163	5.4	61.27	13.55	2	383	
8.166	5.6	61.13	13.41	3	383	
8.177	5.7	61.65	13.41	3	383	
8.185	6.1	61.65	13.29	3	383	
1878.157		61.50	13.409			
	$\Delta\rho=$	− 0.01	+ 0.005			
		61.49	13.414			

B and *D*.

Date.	Sid. Time.	*p*	*s*	Wt.	Power.	Remarks.
1878.142	5.8	94.95	21.49	3	383	
8.161	5.9	95.65	21.67	3	383	
8.163	5.9	95.75	21.76	2	383	
8.166	6.1	95.47	21.78	2	383	

B and *D*—Continued.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1878.177	6.5	95.75	21.67	3	383	
8.185	6.4	95.70	21.57	3	383	
8.218	6.8	95.95	21.72	2	383	
1878.173		95.60	21.666			
	Δρ =	0.00	+ 0.006			
		95.60	21.672			

C and *B*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.142	5.5	213.30	8.76	3	383	
8.161	5.9	214.13	8.92	3	383	
8.163	5.6	213.23	8.75	2	383	
8.166	5.8	213.87	8.78	2	383	
8.177	6.0	213.27	8.75	3	383	
8.218	6.5	213.50	8.80	2	383	
1878.171		213.55	8.793			
	Δρ =	− 0.01	+ 0.004			
		213.54	8.797			

C and *D*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.142	6.1	119.03	19.37	3	383	
8.161	6.2	118.65	19.38	3	383	
8.163	6.1	119.67	19.36	2	383	
8.166	6.3	119.10	19.33	2	383	
8.177	6.8	119.60	19.40	3	383	
8.218	7.3	119.05	19.48	2	383	
1878.171		119.18	19.387			
	Δρ =	0.00	+ 0.006			
		119.18	19.393			

C and *a*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.177	7.0	154.27	19.96	3	383	
8.224	6.6	154.23	20.09	2	383	
8.226	6.7	154.43	20.01	3	383	
1878.209		154.31	20.020			
	Δρ =	0.00	+ 0.007			
		154.31	20.027			

C and *b*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1878.226	8.0	238.53	6.38	2	383	
8.232	7.5	237.37	. .	2	383	
8.235	7.5	239.15	6.53	3	383	
1878.231		238.35	6.455			

D and *a*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.226	6.9	225.63	12.06	2	383	
8.232	7.2	224.13	12.00	2	383	
1878.229		224.88	12.030			

D and *b*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.226	7.3	285.43	23.15	2	383	
8.270	8.2	285.45	23.02	2	383	
1878.248		285.44	23.085			
	$\Delta p =$	− 0.01	+ 0.007			
		285.43	23.092			

For the four principal stars, *A*, *B*, *C*, *D*, we have from the observations of 1877

$$\alpha = +\ 8''.6084 \qquad \beta = -\ 9''.9450$$
$$\alpha' = +\ 16.0633 \qquad \beta' = -\ 5.0710$$
$$\alpha'' = +\ 6.5259 \qquad \beta'' = +\ 11.8362$$

The following are the equations of condition:

(1877).

ξ	η	ξ'	η'	ξ''	η''	n	Residuals.
							"
9.8159	9.8786*n*	. .	. .	. .	. .	. .	− 0.029
. .	. .	9.9794	9.4786*n*	. .	. .	. .	− 0.034
. .	. .	. .	. .	9.6838	9.9424	. .	− 0.021
9.9221	9.7396	9.9221*n*	9.7396*n*	. .	. .	9.2380*n*	− 0.039
8.9816*n*	9.9980	. .	. .	8.9816	9.9980*n*	9.3160*n*	− 0.108
. .	. .	9.6883*n*	9.9410	9.6883	9.9410*n*	8.7404	+ 0.072
9.8786*n*	9.8159*n*	. .	. .	. .	. .	. .	+ 0.075
. .	. .	9.4786*n*	9.9794*n*	. .	. .	. .	+ 0.054
. .	. .	. .	. .	9.9424	9.6838*n*	. .	+ 0.025
9.7396	9.9221*n*	9.7396*n*	9.9221	. .	. .	8.2815*n*	− 0.066
9.9980	8.9816	. .	. .	9.9980*n*	8.9816*n*	8.1730*n*	+ 0.021
. .	. .	9.9410	9.6883	9.9410*n*	9.6883*n*	8.8879	+ 0.019

Assigning to each equation the weight unity, the solution by least squares gives,

$$\begin{array}{ll} \xi \;\; = +\,0''.0375 & \eta \;\; = +\,0''.0716 \\ \xi' \;= -\,0.0489 & \eta' \;= -\,0.0412 \\ \xi'' = +\,0.0114 & \eta'' = -\,0.0304 \end{array}$$

The sum of the squares of the residuals is by elimination 0.03562, and by substitution 0.03513. The probable error of a single equation is, therefore, $\pm 0''.052$.

From the observations of 1878 we have for the same stars,

$$\begin{array}{ll} \alpha \;\; = +\;\;8''.6196 & \beta \;\; = -\;10''.0037 \\ \alpha' \;= +\,16.0030 & \beta' \;= -\;\;5.0304 \\ \alpha'' = +\;\;6.4027 & \beta'' = +\,11.7875 \end{array}$$

(1878).

ξ	η	ξ'	η'	ξ''	η''	n	Residuals.
							"
9.8148	9.8794n	. .	. .	. .	. .	. .	− 0.072
. .	. .	9.9795	9.4769n	. .	. .	. .	− 0.030
. .	. .	. .	. .	9.6788	9.9439	. .	+ 0.005
9.9209	9.7424	9.9209n	9.7424n	. .	. .	9.0212n	+ 0.003
8.9894n	9.9979	. .	. .	8.9894	9.9979n	9.3655n	− 0.114
. .	. .	9.6880n	9.9411	9.6880	9.9411n	8.4393	+ 0.057
9.8794n	9.8148n	. .	. .	. .	. .	. .	− 0.045
. .	. .	9.4769n	9.9795n	. .	. .	. .	+ 0.069
. .	. .	. .	. .	9.9439	9.6788n	. .	+ 0.068
9.7424	9.9209n	9.7424n	9.9209	. .	. .	8.8187	− 0.031
9.9979	8.9894	. .	. .	9.9979n	8.9894n	8.9025	+ 0.016
. .	. .	9.9411	9.6880	9.9411n	9.6880n	9.2605	+ 0.072

Giving, as before, to each equation the weight unity, the solution by least squares gives the following values of the corrections:

$$\begin{array}{ll} \xi \;\; = -\,0''.0128 & \eta \;\; = +\,0''.0840 \\ \xi' \;= -\,0\;.0492 & \eta' \;= -\,0\;.0564 \\ \xi'' = +\,0\;.0620 & \eta'' = -\,0\;.0276 \end{array}$$

The sum of the squares of the residuals is by elimination $0''.03963$, and by substitution $0''.04017$. Hence the probable error of a single equation is $\pm\,0''.055$.

In both years the probable error of an equation of weight unity is nearly the same as that of a single observation; and this result shows that, as in the case of the triangles, the systematic errors committed in measuring the parts of the quadrilateral have not exerted too great an influence. Applying the corrections to the values of α,

α', α'', β, β', β'', we have the following values of the angles and distances of the four principal stars of this group:

(1877).

$p = 311^\circ.208$,	$s = 13''.124$,	*A* and *B*.
$p' = 342\ .296$,	$s' = 16\ .810$,	*A* *C*.
$p'' = 61\ .025$,	$s'' = 13\ .495$,	*A* *D*.
$p''' = 32\ .869$,	$s''' = 8\ .773$,	*B* *C*.
$p^{\text{IV}} = 95\ .555$,	$s^{\text{IV}} = 21\ .781$,	*B* *D*.
$p^{\text{V}} = 119\ .256$,	$s^{\text{V}} = 19\ .392$,	*C* *D*.

Epoch, 1877.142.

(1878).

$p = 310^\circ.946$,	$s = 13''.133$,	*A* and *B*.
$p' = 342\ .315$,	$s' = 16\ .745$,	*A* *C*.
$p'' = 61\ .201$,	$s'' = 13\ .420$,	*A* *D*.
$p''' = 33\ .338$,	$s''' = 8\ .794$,	*B* *C*.
$p^{\text{IV}} = 95\ .643$,	$s^{\text{IV}} = 21\ .785$,	*B* *D*.
$p^{\text{V}} = 119\ .391$,	$s^{\text{V}} = 19\ .335$,	*C* *D*.

Epoch, 1878.162.

The relative proper motions of these four stars, which probably form a physical system, have been discussed by several astronomers, but these motions seem to be small and not yet determined with certainty. In what precedes I have omitted the two small stars *a* and *b*, since they are more difficult to observe.

It will be seen that in the case of the triangles and the quadrilateral the residuals indicate no important systematic errors. But probably some compensation of these errors will occur when all the parts of the figure are measured at nearly the same hour angle; and in future observations of this kind it would be interesting to measure some of the parts at quite different hour angles.

During my observations I never saw any star within the trapezium, and several careful examinations were made.

§ 7.

OBSERVATIONS OF DOUBLE STARS.

1875–1880.

The following observations of double stars with the 26-inch refractor were made at times when the instrument was not needed for its principal work on satellites and nebulæ. Most of these stars are those observed by the STRUVES, but a few other stars have been observed, chiefly those discovered by Mr. S. W. BURNHAM.

Nearly all these observations depend on four settings of the position circle, and on two measurements of the double distance As has been stated before, a few of my early observations of the distances depend on four measurements; but I soon found that two measurements give all the accuracy necessary on a single night; and probably a single careful measurement is sufficient, although it is better to make two as a

check on the readings of the micrometer. The varying condition of the images of the stars from night to night is such that a better result is obtained by increasing the number of nights of observation, rather than by repeating the measurements of a single night. A few measurements of the quadruple distance were made among the early observations, but this method was not satisfactory, and the results, although printed, have been rejected in taking the means.

I have revised all the work, and hope that no important errors remain in the reductions. A few cases occur where it is probable that some error was made in reading the micrometer, and in such cases the result is printed but is not included in the mean value. All results that have been rejected in taking the means are inclosed in parentheses. No attempt has been made to discover new double stars, of which a great number of the fainter kind might be found with this instrument; but a few have been found by Mr. G. Anderson in the course of our work and are designated by the letters G. A. with a number attached.

The following table showing the probable errors of a single observation has been computed by Professor Frisby. In this computation the formula for the residuals themselves and not their squares has been used, and all the stars have been included. In some cases the observations were made with difficulty, as in the case of Marth's distant companion of Sirius and Burnham's distant companion of Aldebaran; so that the probable errors are greater than they would be for stars of the same distance and of sufficient brightness to observe with ease. The first column gives the order of the star according to W. Struve, except that the Order VIII includes all stars of a distance greater than 24″.

Probable Errors of a single observation.

Order.	Mean Distance.	$r_1 p$	$r_1 s$	Number of observations.
	″	″	″	
I	0.66	± 0.025	± 0.049	276
II	1.29	0.028	0.075	282
III	2.98	0.065	0.081	281
IV	5.58	0.100	0.066	192
V	9.91	0.145	0.108	53
VI	14.60	0.160	0.112	33
VII	20.74	0.163	0.108	33
VIII	53.03	0.352	0.270	34

The observations are printed in the following manner, which has been chosen in order to avoid as far as possible the introduction of notes and remarks. First the name of the star is given, and on the next line is its position for 1880 and the magnitudes; taken when possible from the Struves. The first column gives the date of the observation, the third decimal of the year being printed in order to indicate the day. The second column gives the sidereal time of the observation to the nearest tenth of an hour, and the next two columns the angle of position and the distance, p

and *s*. The fifth and sixth columns give the weight of the observation and the magnifying power, and the last the remarks on the observations In deriving the mean results I have generally taken the simple mean without regard to the weights or the remarks; but when the remark is added "images blurred," or "images indistinct," I have given to the observation a weight of one-half. The mean value of the corrections for differential refraction has been applied to the result of the observations. This correction is denoted by $\Delta\rho$.

Σ. 3063.

$\alpha = 0^h\ 1^m.5 \quad \delta = -5°\ 12'$ (9 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1878.046	2.3	222.2	1.91	2	606	
8.051	2.2	222.4	1.86	3	383	
1878.048		222.30	1.885			

Σ. 2.

$\alpha = 0^h\ 2^m.7 \quad \delta = 79°\ 2'$ (6 and 7).

1879.083		Not separated.		3	888	
9.845		Not separated.		3	888	

O. Σ. 2. *A* and *B*.

$\alpha = 0^h\ 7^m.4 \quad \delta = 26°\ 20'$ (7 and 8).

1879.787	0.1	39.4	0.70	3	888	
9.817	23.4	44.8	0.81	2	606	
9.845	22.4	41.5	0.63	2	888	
1879.816		41.90	0.713			

O. Σ. 2. *A* and *C*. (7 and 10).

1879.787	0.0	224.5	17.55	3	606	
9.817	23.5	224.4	17.59	2	606	
1879.802		224.45	17.570			
	$\Delta\rho$	0.00	+ 0.005			
		224.45	17.575			

Σ. 13.

$\alpha = 0^h\ 9^m.1 \quad \delta = 76°\ 19'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.828	23.5	89.6	0.65	2	888	Very unsteady.
9.834	21.7	94.4	0.54	3	888	
9.844	22.1	95.7	0.63	3	888	
1879.835		93.23	0.607			

Σ. 19.

$\alpha = 0^h\ 10^m.6 \quad \delta = 35°\ 58'$ (7 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.976	1.3	126.5	2.43	3	383	
5.979	0.8	127.6	2.68	2	383	
1875.977		127.05	2.555			

Σ. 23.

$\alpha = 0^h\ 11^m.3 \quad \delta = -0°\ 21'$ (7 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.976	1.5	350.8	8.76	3	383	
5.979	0.5	352.6	8.63	2	383	
1875.977		351.70	8.695			

Σ. 24.

$\alpha = 0^h\ 12^m.3 \quad \delta = 25°\ 29'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.051	2.6	249.2	5.23	2	383	
8.054	2.2	248.6	5.09	3	383	
1878.052		248.90	5.160			

λ Cassiopeæ.

$\alpha = 0^h\ 25^m.2 \quad \delta = 53°\ 52'$ (5 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.083	3.3	319.9	0.45	3	888	
9.097	3.1	319.9	0.39	2	888	
9.105	3.3	324.8	0.40	2	888	
9.108	3.7	315.8	0.39	2	888	
1879.098		320.10	0.408			

Σ. 44.

$\alpha = 0^h\ 32^m.0$ $\delta = 40°\ 20'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.061	3.8	264.9	9.18	3	383	
9.064	3.1	265.1	9.23	2	383	
1879.063		265.00	9.205			

Σ. 51.

$\alpha = 0^h\ 37^m.3$ $\delta = 16°\ 42'$ (8 and 10).

1879.844	22.8	130.1	4.11	2	606	
9.864	22.9	129.6	4.38	2	383	
9.866	22.9	129.8	4.20	3	383	Clouds.
1879.858		129.83	4.230			

78 Cassiopeæ = Σ. 59.

$\alpha = 0^h\ 41^m.2$ $\delta = 50°\ 47'$ (7 and 8).

1879.853	23.7	144.9	2.18	2	606	
9.861	23.1	145.0	2.16	3	606	
1879.857		144.95	2.170			

η Cassiopeæ = Σ. 60.

$\alpha = 0^h\ 41^m.7$ $\delta = 57°\ 11'$ (4 and 8).

1878.859	21.6	154.5	5.28	3	383	
8.968	2.6	154.7	5.45	3	383	
1878.971	1.7	155.5	5.51	2	383	Through clouds.
1879.056	2.7	156.2	5.28	2	383	
9.061	3.2	160.8	5.24	2	383	Image very blazing.
9.064	2.6	156.0	5.42	2	383	Windy and unsteady.
9.081	3.9	160.2	5.30	2	383	Clouds.
1879.009		156.84	5.354			

65 Piscium = Σ. 61.

$\alpha = 0^h\ 43^m.4$ $\delta = 27°\ 4'$ (6 and 6).

1875.979	1.0	112.0	4.67	3	383	
1875.989	1.0	113.6	4.51	3	383	
1876.896	0.0	295.3	4.56	2	383	
1876.929	0.3	117.5	4.55	2	383	
1877.076	2.7	118.2	4.47	3	383	
1877.085	2.7	115.4	4.58	2	383	
1876 659		115.33	4.557			

36 Andromedæ = Σ. 73.

$\alpha = 0^h\ 48^m.3 \quad \delta = 22° 58'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1875.979	1.5	3.1	1.39	2	383	Quite hazy.
1875.990	1.5	0.4	1.27	2	383	
1876.009	. .	356.4	1.24	3	383	
1876.011	. .	355.7	1.46	3	383	
1876.020	1.0	356.9	1.12	2	383	
1878.873	23.2	174.6	1 36	2	383	Images blurred.
1878.875	22.2	359.1	1.29	3	383	
1876.822		358.03	1.304			

Σ. 80.

$\alpha = 0^h\ 53^m.3 \quad \delta = 0° 9'$ (7 and 8).

1879.740	23.7	313.4	20.20	3	606	
9.754	23.6	313.7	20.23	3	606	
9.768	23.6	313.4	20.12	3	606	
1879.754		313.50	20.183			
	$\Delta\rho =$	0.00	+ 0.009			
		313.50	20.192			

Σ. 86.

$\alpha = 0^h\ 58^m.7 \quad \delta = -6° 7'$ (8 and 9).

1876.058	2.5	161.1	. .	2	383	Clouds.
6.066	3.0	159.5	13.12	3	383	
6.069	2.7	159.4	12.92	4	383	
1876.064		160.00	13.020			
	$\Delta\rho =$	− 0.01	+ 0.006			
		159.99	13.026			

201 Piscium.

$\alpha = 1^h\ 3^m.1 \quad \delta = 23° 9'$ (7 and 9).

1877.085	3.0	104.6	0.53	3	888	
7.090	2.7	104.7	0.60	3	888	
1877.088		104.65	0.565			

Σ. 113.

$a = 1^h\ 13^m.7 \quad \delta = -1°\ 8' \quad$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1876.072	2.8	351.9	1.24	3	383	
6.085	2.5	351.0	1.26	3	383	
1876.078		351.45	1.250			

Anonyma.

$a = 1^h\ 14^m.1 \quad \delta = -16°\ 25' \quad$ (7 and 7).

1879.784	0.8	24.6	1.51	3	606	
9.787	0.4	23.0	1.59	2	383	
1879 786		23.80	1.550			

Σ. 118.

$a = 1^h\ 20^m.6 \quad \delta = 82°\ 44' \quad$ (8 and 10).

1879.853	23.4	73.1	11.90	3	606	
9.861	23.4	72.7	11.77	2	606	
1879.857		72.90	11.835			
	$\Delta\rho =$	− 0.07	+ 0.005			
		72.83	11.840			

Σ. 122.

$a = 1^h\ 20^m.7 \quad \delta = 2°\ 55' \quad$ (7 and 9).

1878.054	2.6	328.5	6.15	3	383	
8.068	2.8	327.4	5.99	3	383	The principal star not double.
1878.061		327.95	6.070			

Σ. 133. *A* and *B*.

$a = 1^h\ 25^m.9 \quad \delta = 35°\ 13' \quad$ (7 and 11).

1878.837	23.3	186.1	2.88	3	383	
8.845	23.8	183.7	3.10	3	383	
8.848	23.1	183.8	2.93	2	383	
1878.843		184.53	2.970			

Σ. 133. *A* and *C*. (7 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1878.837	23.5	197.4	26.72	3	383	
8.845	23.9	197.5	26.71	3	383	
8.848	23.3	197.3	26.68	3	383	
1878.843		197.40	26.703			
	$\Delta\rho =$	0.00	+ 0.007			
		197.40	26.710			

Σ. 133. *C* and *D*. (11 and 12).

1878.837	23.7	168.7	5.06	3	383	
8.845	0.1	168.8	5.06	3	383	
8.848	23.5	169.1	5.06	3	383	
1878.843		168.87	5.060			

Σ. 138. *A* and *B*.

$\alpha = 1^h\ 30^m.0$ $\delta = 7°\ 0'$ (7 and 7).

1875.989	2.0	34.1	1.51	3	383	
6.009	. .	32.1	1.38	3	383	
6.099	3.5	34.2	1.27	2	383	
1876.032		33.47	1.387			

Σ. 138. $\frac{A+B}{2}$ and *C*.

1875.989	2.2	62.3	22.50	2	383	*C* is 14th mag.
6.009	. .	63.4	22.00	2	383	*C* is 15th mag.
1875.999		62.85	22.250			
	$\Delta\rho =$	0.00	+ 0.007			
		62.85	22.257			

Σ. 155.

$\alpha = 1^h\ 37^m.8$ $\delta = 8°\ 51'$ (7 and 8).

1876.099	4.2	326.9	4.71	3	383	
6.107	3.6	328.2	4.79	3	383	
1876.103		327.55	4.750			

Σ. 158.

$\alpha = 1^h\ 39^m.8$ $\delta = 32°\ 35'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.784	1.1	257.1	2.09	3	606	
9.787	1.5	257.8	2.03	3	606	Cloudy.
1879.786		257.45	2.060			

Σ. 183. *A* and *B*.

$\alpha = 1^h\ 48^m.3$ $\delta = 28°\ 13'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.894	23.3	6.9	0.49	2	888	
9.899	23.6	11.7	0.47	3	888	
9.907	23.8	12.3	0.51	2	888	
9.916	0.4	10.3	0.47	3	888	
1879.904		10.30	0.485			

Σ. 183. $\frac{A+B}{2}$ and *C*. (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.894	23.5	165.0	5.70	2	888	
9.899	23.8	164.2	5.73	2	888	
1879.897		164.60	5.715			

Σ. 186.

$\alpha = 1^h\ 49^m.7$ $\delta = 1°\ 15'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.784	1.3	2.4	0.37	3	888	
9.916	1.0	1.7	0.30	3	888	
9.965	0.4	357.4	0.27	3	888	
1879.888		0.50	0.313			

Σ. 202.

$\alpha = 1^h\ 55^m.8$ $\delta = 2°\ 11'$ (4 and 5).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.113	3.4	322.1	3.18	3	383	
6.118	3.2	322.4	3.10	3	383	
8.949	0.3	325.9	2.90	3	383	
8.952	1.8	325.2	3.04	2	383	
8.968	0.5	325.5	3.02	3	383	
1877.820		324.22	3.048			

γ^1 **Andromedæ** $= \Sigma.$ **205** A and $\frac{B+C}{2}$.

$\alpha = 1^h\ 56^m.5$ $\delta = 41^\circ\ 46'$ (3 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1875.970	2.0	62.4	10.46	3	606	
5.979	1.0	62.8	10.54	3	383	
1875.974		62.60	10.500			
	$\Delta\rho$	0.00	+ 0.003			
		62.60	10.503			

γ^2 **Andromedæ** $= O. \Sigma.$ **38.** (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.104	3.2	97.3	0.35	3	888	
7.109	. .	101.0	0.38	2	888	
7.112	3.1	104.6	0.37	2	888	
7.115	3.5	103.6	0.37	3	888	
1877.117	3.6	103.2	0.43	2	888	
1880.037	1.9	99.1	0.33	2	888	
0.039	2.0	95.8	0.35	2	888	
0.045	2.4	103.4	0.28	3	888	
1878.210		101.00	0.358			

$\Sigma.$ **208.**

$\alpha = 1^h\ 56^m.8$ $\delta = 25^\circ\ 22'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.046	2.8	46.6	1.19	2	383	
8.051	3.0	45.5	1.27	2	383	
1878.048		46.05	1.230			

ι **Trianguli** $= \Sigma.$ **227.**

$\alpha = 2^h\ 5^m.4$ $\delta = 29^\circ\ 44'$ (5 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.076	3.2	76.9	3.62	3	383	
7.079	2.4	74.6	3.76	3	383	
7.082	2.4	77.7	3.99	2	383	Images much blurred.
7.085	2.4	77.6	3.70	3	383	
1877.080		76.70	3.768			

Σ. 228.

$a = 2^h\ 6^m.3$ $\delta = 46°\ 55'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1877.115	3.8	312.4	0.54	3	888	
*7.117	3.9	313.9	0.53	2	888	
7.126	3.6	317.7	0.54	2	888	
7.128	3.7	310.3	0.55	3	888	
1877.121		313.58	0.540			

Lalande 4219.

$a = 2^h\ 10^m.1$ $\delta = -18°\ 47'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.918	1.2	311.7	2.20	3	383	
9.921	1.4	312.0	2.25	3	383	
1879.920		311.85	2.225			

ι Cassiopeæ = Σ. 262. *A* and *B*.

$a = 2^h\ 19^m.2$ $\delta = 66°\ 52'$ (4 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.064	3.6	263.9	2.29	2	383	
9.083	3.8	260.1	2.01	3	383	
9.105	3.7	263.2	2.12	3	383	
1879.084		262.40	2.140			

ι Cassiopeæ. *A* and *C*. (4 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.064	3.8	107.7	7.39	2	383	
9.083	3.9	108.1	7.56	3	383	
9.105	3.8	110.9	7.54	2	383	
1879.084		108.90	7.497			

Σ. 295.

$a = 2^h\ 35^m.1$ $\delta = -1°\ 12'$ (6 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.979	. .	325.3	4.79	2	383	
9.029	1.8	326.2	4.84	3	383	
9.050	2.5	323.8	4.89	2	383	
1879.019		325.10	4.840			

Σ. 296.

$a = 2^h\ 35^m.9$ $\delta = 48°\ 43'$ (4 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.083	4.3	298.0	16.69	3	383	

107 Arietis.

$a = 2^h\ 36^m.7$ $\delta = 25°\ 5'$ (7 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.989	. .	15.7	3.05	2	383	
6.009	. .	15.1	3.21	3	383	
6.020	2.5	16.2	3.05	3	383	
7.071	3.3	16.6	3.11	2	383	
7.074	2.4	15.9	2.99	3	383	
1876.433		15.90	3.082			This star was discovered by S. W. BURNHAM.

γ Ceti = Σ. 299.

$a = 2^h\ 37^m.0$ $\delta = 2°\ 45'$ (3 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.031	. .	287.8	3.09	3	383	
6.033	2.5	286.4	3.06	3	383	
9.938	1.5	283.8	2.97	2	383	
9.948	1.5	285.8	3.04	2	323	
1877.988		285.95	3.040			

Lalande 5133.

$a = 2^h\ 40^m.3$ $\delta = 29°\ 10'$ (8 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.039	. .	315.5	15.88	2	383	Comp. is 11 mag.
7.750	23.3	316.6	15.18	2	383	Images blazing.
7.753	1.0	315.6	15.24	2	383	
1877.181		315.90	15.433			
	$\Delta\rho =$	0.00	+ 0.006			
		315.90	15.439			This star was discovered by S. W. BURNHAM.

Σ. 305.

$a = 2^h\ 40^m.7$ $\delta = 18°\ 52'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.069	3.8	321.1	2.87	3	383	
6.072	3.5	320.3	2.66	3	383	
6.085	4.3	321.6	2.83	3	383	
1876.075		321.00	2.787			

Σ. 314.

$\alpha = 2^h\ 44^m.3$ $\delta = 52°\ 30'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1880.009	1.2	303.4	1.43	3	383	
0.022	1.5	303.6	1.49	3	383	
0.044	2.7	299.8	1.52	3	383	
1880.025		302.27	1.480			

Σ. 312. *A* and *B*.

$\alpha = 2^h\ 44^m.8$ $\delta = 72°\ 26'$ (7 and 8).

1879.165	5.1	20.2	3.20	2	383	
9.995	0.9	21.5	3.18	2	383	
1879.580		20.85	3.190			

Σ. 312. *A* and *C*. (7 and 9).

1879.165	5.3	128.10	42.53	2	383	
9.995	1.1	128.48	42.65	2	383	
1879.580		128.29	42.590			
	$\Delta\rho =$	0.00	+ 0.014			
		128.29	42.604			

Σ. 326.

$\alpha = 2^h\ 48^m.5$ $\delta = 26°\ 24'$ (8 and 10).

1879.853	2.5	216.4	8.43	3	606	
9.921	2.4	216.2	8.34	3	383	
1879.887		216.30	8 385			

ε Arietis = Σ. 333.

$\alpha = 2^h\ 52^m.3$ $\delta = 20°\ 51'$ (5 and 6).

1876.066	4.0	200.8	(1.52)	2	383	Quadruple dist.; images blazing.
6.069	4.1	200.6	1.18	3	383	
6.072	4.0	201.8	1.14	2	383	
6.132	4.2	204.6	1.20	2	383	Images blurred.
1876.078		201.57	1.168			

Σ. 355.

$\alpha = 3^h\ 0^m.9 \quad \delta = 7°\ 56'$ (9 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.948	3.0	146.3	2.81	3	383	
9.957	2.1	147.1	2.85	2	383	
1879.952		146.70	2.830			

Σ. 360.

$\alpha = 3^h\ 4^m.5 \quad \delta = 36°\ 46'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.987	2.7	135.5	1.83	3	383	
1879.995	1.4	139.1	1.57	3	383	Haze.
1880.009	2.0	139.1	1.68	3	383	
1879.997		137.90	1.693			

12 Eridani.

$\alpha = 3^h\ 7^m.0 \quad \delta = -29°\ 27'$ (4 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.068	3.3	311.9	. .	2	383	Driving clock stopped.
1880.009	3.3	314.5	2.54	2	383	
0.036	2.6	312.5	2.71	2	383	
0.039	3.1	307.7	2.55	2	383	
1879.538		311.65	2.600			

Σ. 367.

$\alpha = 3^h\ 7^m.9 \quad \delta = 0°\ 18'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.046	3.2	246.6	0.70	2	606	
8.051	3.3	245.4	0.89	2	383	
1878.048		246.00	0.795			

Σ. 380.

$\alpha = 3^h\ 15^m.3 \quad \delta = 8°\ 20'$ (9 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1880.009	3.5	73.9	1.27	3	606	
0.023	2.3	74.1	1.12	2	606	
1880.016		74.00	1.195			

Σ. 381.

$a = 3^h\ 16^m.4 \qquad \delta = 20^\circ\ 34'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1878.051	3.7	96.3	0.93	2	383	
8.100	3.6	96.1	0.78	3	383	
1878.076		96.20	0.855			

Σ. 389.

$a = 3^h\ 20^m.5 \qquad \delta = 58^\circ\ 57'$ (7 and 8).

1880.009	1.8	65.6	2.71	4	383	
0.022	1.7	65.5	2.72	3	383	
0.044	2.9	65.9	2.66	3	383	
1880.025		65.67	2.697			

Σ. 408.

$a = 3^h\ 24^m.7 \qquad \delta = -4^\circ\ 42'$ (8 and 8).

1878.079	3.4	340.1	1.23	2	383	
8.100	3.9	339.8	1.25	3	383	
1878.089		339.95	1.240			

Σ. 400.

$a = 3^h\ 25^m.2 \qquad \delta = 59^\circ\ 37'$ (7 and 8).

1879.165	5.6	302.1	0.68	2	606	
1880.009	1.5	301.6	0.72	3	606	
1879.587		301.85	0.700			

Σ. 412.

$a = 3^h\ 27^m.2 \qquad \delta = 24^\circ\ 3'$ (7 and 10).

1878.051	4.1	60.47	22.15	2	383	
8.073	2.8	60.20	22.41	2	383	Poor images and principal star not divided.
1878.062		60.33	22.280			
	$\Delta\rho =$	0.00	+ 0.006			
		60.33	22.286			

Σ. 422.

$\alpha = 3^h\ 30^m.6$ $\delta = 0°\ 12'$ (6 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1880.009	3.7	242.0	6.51	4	383	
0.022	2.5	242.5	6.51	3	383	
0.036	2.8	241.2	6.40	2	383	
1880.022		241.90	6.473			

Weisse 564.

$\alpha = 3^h\ 32^m.0$ $\delta = -8°\ 5'$ (9 and 10).

1876.009	. .	332.4	1.73	2	383	
6.031	. .	334.1	1.37	2	383	
6.033	3.0	332.1	1.86	3	383	
1876.024		332.87	1.653			This star was discovered by S. W. Burnham.

Σ. 460.

$\alpha = 3^h\ 50^m.0$ $\delta = 80°\ 22'$ (5 and 6).

1879.108	4.8	29.2	0.93	2	888	Images blurred.
9.166	5.8	32.0	0.90	2	606	Images blurred.
1879.137		30.60	0.915			

O. Σ. 531.

$\alpha = 3^h\ 59^m.5$ $\delta = 37°\ 46'$ (7 and 9).

1880.009	2.6	136.1	2.68	3	383	
0.022	2.0	137.8	2.57	3	383	
0.036	3.0	138.0	2.67	3	383	
1880.022		137.30	2.640			

Lalande 7655.

$\alpha = 4^h\ 1^m.3$ $\delta = 19°\ 20'$ (8 and 11).

1876.033	3.5	278.2	5.86	3	383	
6.036	3.5	279.3	6.02	2	383	
1876.034		278.75	5.940			This star was discovered by S. W. Burnham.

Σ. 494.

$\alpha = 4^h\ 1^m.8 \quad \delta = 22°\ 46'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1876.096	3.8	186.4	5.27	2	383	
6.107	4.0	185.6	5.29	2	383	
6.113	3.8	186.4	5.27	3	383	
1876.105		186.13	5.277			

Σ. 511.

$\alpha = 4^h\ 7^m.9 \quad \delta = 58°\ 32'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.166	6.2	288.5	0.38	2	888	Images blurred.
1880.009	2.3	286.2	0.39	3	888	
0.044	3.2	286.7	0.42	3	888	
1879.854		286.82	0.400			

O. Σ. 78.

$\alpha = 4^h\ 8^m.5 \quad \delta = 29°\ 45'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.073	3.1	242.7	2.45	2	383	
8.079	4.0	245.8	2.45	2	383	
1878.076		244.25	2.450			This star was found independently by G. ANDERSON, 1878, January 26.

40 Eridani = Σ 518. *A* and *B*.

$\alpha = 4^h\ 9^m.8 \quad \delta = -7°\ 49'$ (4 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.174	5.6	105.60	81.91	2	383	
9.185	5.5	105.54	81.84	2	383	
1879.180		105.57	81.875			
	$\Delta\rho$ =	0.00	+ 0.023			
		105.57	81.898			

40 Eridani. *A* and *D*. (4 and 12).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.185	5.9	136.6	36.32	2	383	D is 14th mag.
	$\Delta\rho$ =	0.0	+ 0.01			
		136.6	36.33			

40 Eridani. *B* and *C*. (10 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.174	5.9	125.0	3.44	2	383	Clouds.
9.185	5.7	125.0	3.59	2	383	
1879.180		125.00	3.515			

Weisse 258.

$\alpha = 4^h\ 14^m.2$ $\delta = 39°\ 36'$ (8 and 12).

1876.039	. .	172.0	19.46	2	383	Comp. 12th mag.
1880.009	2.9	172.3	19.30	3	383	Comp. 13th mag.
1878.024		172.15	19.380			
	$\Delta\rho =$	0.00	+ 0.005			
		172.15	19.385			This star was discovered by S. W. Burnham.

Σ. 536.

$\alpha = 4^h\ 16^m.2$ $\delta = -\ 4°\ 58'$ (8 and 9).

1880.009	4.0	161.0	1.90	3	606	
0.022	2.8	158.7	1.72	2	383	Faint; clouds.
0.036	3.3	160.9	1.88	2	383	
1880.022		160.20	1.833			

O. Σ. 82.

$\alpha = 4^h\ 15^m.9$ $\delta = 14°\ 46'$ (7 and 9).

1879.127	4.1	179.3	0.74	3	383	
9.185	6.4	185.2	0.79	2	606	Images blurred.
1879.156		182.25	0.765			

Σ. 535.

$\alpha = 4^h\ 16^m.7$ $\delta = 11°\ 5'$ (7 and 8).

1876.113	4.0	338.4	1.71	3	383	
6.118	3.4	338.4	1.68	3	383	
6.132	4.6	340.8	1.78	2	383	
1876.121		339.20	1.723			

O. Σ. 85.

$a = 4^h\ 28^m.2$ $\delta = 48°\ 10'$ (8 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1880.044	3.5	27.6	1.40	3	888	
0.058	2.9	31.8	1.41	2	606	
1880.051		29.70	1.405			

Aldebaran.

$a = 4^h\ 29^m.0$ $\delta = 16°\ 16'$ (1 and 15).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.994	2.3	110.55	30.69	2	383	Comp. 14.15 mag.
8.021	3.2	112.25	31.96	2	383	
8.046	4.1	109.55	31.20	3	383	Double weight.
1878.027		110.48	31.262			
	$\Delta\rho =$	0.00	+ 0.010			
		110.48	31.272			This faint companion was discovered by S. W. BURNHAM.

Σ. 567.

$a = 4^h\ 29^m.5$ $\delta = 19°\ 14'$ (9 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.129	. .	317.0	1.76	3	383	
6.132	4.9	315.4	1.95	2	383	
6.135	4.0	317.6	1.81	3	383	
1876.132		316.67	1.840			

Σ. 566.

$a = 4^h\ 30^m.5$ $\delta = 53°\ 15'$ (6 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.281	8.3	294.4	1.67	3	383	
9.305	8.9	294.4	1.55	3	383	
1879.293		294.40	1.610			

Σ. 572.

$a = 4^h\ 31^m.1$ $\delta = 26°\ 42'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1880.036	3.5	23.9	3.70	3	383	
0.039	3.3	26.0	3.49	2	383	
1880.038		24.95	3.595			

Σ. 577.

$a = 4^h\ 34^m.1$ $\delta = 37°\ 15'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.281	8.5	78.9	1.34	4	383	
9.305	9.2	79.1	1.60	3	383	
9.308	9.5	78.9	1.41	3	383	
1879.298		78.97	1.450			

Σ. 589.

$a = 4^h\ 38^m.5$ $\delta = 5°\ 4'$ (8 and 8).

1876.017	. .	299.0	4.65	3	383	
6.020	3.0	301.6	4.61	3	383	
6.099	4.8	299.6	4.55	2	383	
1876.045		300.07	4.603			

Lalande 9065.

$a = 4^h\ 42^m.5$ $\delta = -21°\ 0'$ (8 and 10).

1876.020	4.0	345.1	3.36	3	383	
6.033	4.0	346.3	3.33	3	383	
1876.026		345.70	3.345			This star was discovered by S. W. Burnham.

Lalande 9181.

$a = 4^h\ 46^m.8$ $\delta = -5°\ 29'$ (9 and 9.3).

1876.118	3.7	178.2	1.00	3	383	
6.129	. .	178.5	0.98	3	383	
1876.123		178.35	0.990			This star was discovered by S. W. Burnham.

O. Σ. 91.

$a = 4^h\ 49^m.9$ $\delta = 3°\ 0'$ (7 and 8).

1878.068	4.6	53.8	0.70	2	606	Clock running badly.
8.106	3.7	238.2	0.58	3	606	
1878.087		236.00	0.640			

Σ. 622.

$\alpha = 4^h\ 51^m.9$ $\delta = 1°\ 29'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1880.036	3.8	354.8	2.54	2	383	
0.039	3.6	354.7	2.41	3	383	
1880.038		354.75	2.475			

O. Σ. 92.

$\alpha = 4^h\ 52^m.1$ $\delta = 39°\ 13'$ (6 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.127	4.4	247.6	2.81	3	383	
9.220	6.8	246.7	2.81	2	383	
1879.174		247.15	2.810			

G. A. 1.

$\alpha = 4^h\ 58^m.0$ $\delta = 49°\ 0'$ (10 and 10.5)

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.039	. .	337.8	5.55	2	383	This star was discovered by G. Anderson.

O. Σ. 95.

$\alpha = 4^h\ 59^m.5$ $\delta = 19°\ 41'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1880.052	4.7	333.0	0.79	2	606	
0.058	4.4	336.1	0.93	2	888	
1880.055		334.55	0.860			

O. Σ. 98.

$\alpha = 5^h\ 1^m.3$ $\delta = 8°\ 20'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.081	4.8	205.9	0.92	2	606	Images blurred.
9.127	4.7	205.7	0.86	3	383	
1879.104		205.80	0.890			

Σ. 634.

$\alpha = 5^h\ 2^m.8$ $\delta = 79°\ 5'$ (5 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.313	9.7	1.9	19.74	3	383	
9.316	10.2	1.6	19.75	2	383	Hazy.
1879.314		1.75	19.745			
	$\Delta\rho =$	+ 0.07	+ 0.006			
		1.82	19.751			

Anonyma.

$\alpha = 5^h\ 7^m.0$ $\delta = 1°\ 50'$ (6 and 13).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1876.118	4.6	131.6	6.70	3	383	6 and 13 mags.
1880.036	4.4	137.7	6.77	2	383	14 mag.
1878.077		134.65	6.735			

τ Orionis. *A* and *B*.

$\alpha = 5^h\ 11^m.8$ $\delta = -6°\ 58'$ (4 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.225	7.5	250.6	35.94	3	383	
6.228	7.3	249.6	36.03	3	383	
1876.226		250.10	35.985			
	$\Delta\rho =$	+ 0.02	+ 0.023			
		250.12	36.008			

τ Orionis. *A* and *D*. (4 and 12).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.225	7.2	59.6	35.98	3	383	
6.228	7.0	60.1	35.96	3	383	
1876.226		59.85	35.970			
	$\Delta\rho =$	+ 0.01	+ 0.023			
		59.86	35.993			

τ Orionis. *B* and *C*. (11 and 12).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.225	7.8	50.0	3.62	3	383	
6.228	7.7	47.3	4.06	2	383	Faint.
1876.226		49.10	3.767			

Σ. 676.

$\alpha = 5^h\ 13^m.1$ $\delta = 64°\ 38'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1880.058	2.4	270.8	1.01	2	606	
0.063	2.5	273.3	0.94	2	606	Images blurred.
0.066	2.8	270.3	1.07	2	606	
1880.062		271.47	1.007			

Σ. 677.

$\alpha = 5^h\ 13^m.4 \quad \delta = 63°\ 16'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.281	8.8	259.8	1.58	4	383	
1879.305	9.5	260.4	1.51	3	383	
1880.044	4.3	259.1	1.50	3	606	
1879.543		259.77	1.530			

Σ. 694. *A* and *B*.

$\alpha = 5^h\ 16^m.6 \quad \delta = 24°\ 51'$ (8 and 8).

1876.118	4.2	182.1	1.29	3	383	
6.129	. .	181.9	1.27	2	383	
6.132	5.3	183.7	1.22	3	383	
1876.126		182.57	1.260			

Σ. 694. $\frac{A+B}{2}$ and *C*.

1876.132	5.4	338.6	8.66	2	383	*C* is 15.16 mag.

η Orionis.

$\alpha = 5^h\ 18^m.4 \quad \delta = -2°\ 31'$ (3 and 6).

1876.135	4.4	83.8	1.11	2	383	Images blurred.
6.189	5.9	85.6	1.02	2	606	Images blurred.
1876.162		84.70	1.065			

Oel. Arg. S. 3957.

$\alpha = 5^h\ 21^m.3 \quad \delta = -20°\ 49'$ (8 and 11).

1876.072	4.5	231.8	3.78	2	383	Images blurred.
6.085	4.6	230.9	3.98	3	383	
6.113	4.8	231.5	4.07	3	383	
1876.094		231.32	3.976			This star was discovered by S. W. Burnham.

118 Tauri = Σ. 716.

$\alpha = 5^h\ 21^m.9 \quad \delta = 15°\ 3'$ (7 and 8).

1876.129	. .	200.2	5.12	2	383	
6.135	5.2	198.3	5.07	3	383	
6.176	5.8	196.3	4.97	2	383	
6.187	5.9	198.1	5.00	3	383	
1876.157		198.22	5.040			

β Leporis.

$\alpha = 5^h\ 23^m.1 \qquad \delta = -\ 20°\ 51'$ (3 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1876.085	5.0	280.4	3.16	3	383	Comp. 10.5 mag.
6.132	5.7	283.6	. .	2	383	Images blurred.
6.135	4.7	279.0	3.08	3	383	
7.115	5.5	284.0	3.20	3	383	
7.117	5.3	286.1	3.21	2	383	
7.129	5.3	284.7	3.07	3	383	
1879.949	5.7	281.1	3.08	2	383	
1880.009	4.3	281.5	3.02	3	383	Comp. 11th mag.
1877.459		282.55	3.117			This star was discovered by S. W. Burnham.

Σ. 735.

$\alpha = 5^h\ 27^m.0 \qquad \delta = -\ 6°\ 35'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.099	5.8	352.6	37.84	2	383	
6.107	5.1	352.9	37.93	2	383	
1876.103		352.75	37.885			
	$\Delta\rho =$	0.00	+ 0.021			
		352.75	37.906			

λ Orionis = Σ. 738.

$\alpha = 5^h\ 28^m.5 \qquad \delta = 9°\ 51'$ (4 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.135	5.5	45.0	4.57	3	383	
6.176	6.2	45.1	4.51	2	383	
6.187	6.4	41.6	4.92	2	383	Image much blurred.
6.189	6.3	42.5	4.46	3	383	
1876.170		43.83	4.571			

Σ. 742.

$\alpha = 5^h\ 29^m.2 \qquad \delta = 21°\ 55'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.069	5.3	256.2	3.58	2	383	Images diffuse.
6.072	5.0	252.6	3.74	3	383	
6.107	4.7	254.0	3.53	3	383	
1876.083		254.27	3.617			

ζ Orionis = Σ. 774.

$\alpha = 5^h\ 34^m.7 \quad \delta = -2°\ 0' \quad$ (2 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1876.176	6.6	157.0	2.78	2	383	Image much blurred.
6.189	6.8	156.8	2.70	2	383	
1876.185		156.87	2.727			

Σ. 787.

$\alpha = 5^h\ 38^m.8 \quad \delta = 21°\ 16' \quad$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1880.053	5.1	70.6	1.12	2	606	
0.058	4.6	71.4	1.30	2	606	
1880.056		71.00	1.210			A 14th mag. star $p = 50°$; $s = 11''$, by estimation.

G. A. 2.

$\alpha = 5^h\ 47^m.0 \quad \delta = -20°\ 0' \quad$ (8 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.069	4.8	18.7	9.01	2	383	
6.113	5.3	20.1	9.20	2	383	
1876.091		19.40	9.105			This star was discovered by G. ANDERSON.

41 Aurigæ = Σ. 845.

$\alpha = 6^h\ 2^m.4 \quad \delta = 48°\ 44' \quad$ (5 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.308	9.2	353.9	7.85	3	383	
9.313	9.3	354.1	7.88	2	383	
9.316	9.9	353.6	7.86	3	383	
1879.312		353.87	7.863			

Σ. 853.

$= 6^h\ 2^m.5 \quad \delta \quad 11°\ 41' \quad$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.113	5.5	348.9	27.04	3	383	Clouds.
6.118	6.1	348.8	26.97	3	383	
1876.116		348.85	27.005			
	$\Delta\rho =$	0.00	+ 0.010			
		348.85	27.015			

Lalande 11915.

$\alpha = 6^h\ 8^m.7 \quad \delta = -1°\ 41'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1876.170	6.1	92.7	2.18	2	383	
6.173	5.6	93.5	2.16	2	383	
1876.172		93.10	2.170			This star was discovered by S. W. BURNHAM.

Σ. 881.

$\alpha = 6^h\ 11^m.4 \quad \delta = 59°\ 26'$ (6 and 8).

1879.280	9.0	102.2	0.67	3	606	
9.305	9.8	101.3	0.80	2	606	
9.308	10.0	100.1	0.85	2	606	
1879.298		101.20	0.773			

G. A. 3. *A* and *B*.

$\alpha = 6^h\ 24^m.0 \quad \delta = 5°\ 0'$ (8.9 and 13.14).

1876.173	7.0	282.4	3.66	3	383	

G. A. 3. *A* and *C*. (8.9 and 14.15).

1876.173	6.8	319.8	7.20	2	383	

G. A. 3. *A* and *D*. (8.9 and 13).

1876.173	7.2	288.4	12.64	3	383	

G. A. 3. *A* and *E*. (8.9 and 12.13).

1876.173	7.4	197.5	13.28	3	383	This star was discovered by G. ANDERSON.

Σ. 932.

$\alpha = 6^h\ 27^m.5 \quad \delta = 14°\ 50'$ (8 and 9).

1876.058	4.7	331.5	2.28	2	383	
6.072	5.3	334.3	2.30	3	383	
6.096	6.4	332.6	2.11	2	383	Bad images.
1876.075		332.80	2.230			

Σ. 945.

$\alpha = 6^h\ 31^m.9 \qquad \delta = 41^\circ\ 7' \qquad$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1880.044	4.6	262.6	1.00	2	606	
0.058	3.7	265.4	0.89	2	888	
1880.051		264.00	0.945			

Σ. 950.

$\alpha = 6^h\ 34^m.4 \qquad \delta = 10^\circ\ 1' \qquad$ (6 and 9).

1876.058	5.0	210.9	3.02	2	383	
6.072	5.8	211.5	3.08	3	383	
6.113	6.0	215.3	3.06	3	383	
1876.081		212.57	3.053			

Σ. 955. *A* and *B*.

$\alpha = 6^h\ 35^m.4 \qquad \delta = -\ 7^\circ\ 53' \qquad$ (9 and 9).

1879.081	5.5	269.3	0.82	2	606	
9.193	7.5	272.5	0.74	2	606	
9.196	6.1	269.3	0.78	3	606	
1879.157		270.37	0.780			

Σ. 955. $\frac{A+B}{2}$ and *C*. (9 and 9).

1879.081	5.7	189.2	11.60	2	606	
9.193	7.7	188.4	11.61	2	606	
9.196	6.2	188.8	11.45	3	606	
1879.157		188.80	11.553			
	$\Delta\rho =$	0.00	+ 0.007			
		188.80	11.560			

Σ. 948. *A* and *B*.

$\alpha = 6^h\ 35^m.6 \qquad \delta = 59^\circ\ 34'. \qquad$ (6 and 7).

1879.280	9.3	131.4	1.54	2	383	
9.305	10.1	131.1	1.60	3	383	
9.308	10.2	130.2	1.74	3	383	
1879.298		130.90	1.627			

Σ. 948. *A* and *C*. (6 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.280	9.4	307.2	8.66	2	383	
9.305	10.3	305.0	8.72	2	383	
9.308	10.4	305.2	8.61	3	383	
1879.298		305.80	8.663			

Sirius.

$\alpha = 6^h\ 39.^m9$ $\delta = -16°\ 33'$ (1 and 13).

1877.128	. .	115.0	70.46	2	383	s uncertain; ½ wt.
7.164	6.8	114.9	72.09	2	383	Comp. 13th mag.
7.936	6.4	114.9	71.08	3	383	
1877.466		114.92	71.36			
	$\Delta\rho =$	− 0.01	+ 0.03			
		114.91	71.39			This faint companion was discovered by A. MARTH.

O. Σ. 159.

$\alpha = 6^h\ 46^m.9$ $\delta = 58°\ 34'$ (5 and 7).

1879.308	10.7	1.8	0.44	2	888	
9.313	10.0	3.1	0.49	3	888	
9.319	9.3	4.6	0.41	3	888	
1879.313		3.17	0.447			

38 Geminorum = Σ. 982.

$\alpha = 6^h\ 47^m.9$ $\delta = 13°\ 20'$. (6 and 8).

1876.113	6.4	162.8	6.42	2	383	Images blurred.
6.118	6.4	164.3	6.34	3	383	
6.129	. .	165.3	6.42	2	383	Images blurred.
6.135	6.3	162.8	6.37	3	383	
1876.125		163.72	6.377			

Lalande 13404.

$\alpha = 6^h\ 49^m.9$ $\delta = 2°\ 28'$ (8 and 9).

1876.170	6.4	62.4	1.23	2	383	Images bad; clouds.
6.173	5.9	63.6	1.23	2	383	Images blurred.
1876.172		63.00	1.230			This star was discovered by S. W. BURNHAM.

O. Σ. 165.

$a = 7^h\ 1^m.5 \quad \delta = 16°\ 8'$ (5 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.185	6.9	75.8	2.96	2	606	
9.193	8.1	71.1	3.01	2	383	Comp. 13th mag.
9.196	6.4	72.5	2.97	3	383	
1879.191		73.13	2.980			

Σ. 1037.

$a = 7^h\ 5^m.3 \quad \delta = 27°\ 26'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.118	7.0	308.8	1.34	2	383	
6.135	6.7	314.9	1.18	3	383	
6.200	. .	311.2	1.30	2	383	
1876.151		311.63	1.273			There is a faint companion of 13th mag.; $p = 100°$: $s = 12''$ by estimation.

Σ. 1066.

$a = 7^h\ 12^m.8 \quad \delta = 22°\ 11'$ (3 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.185	7.3	206.6	7.10	2	606	
9.193	8.4	206.0	7.13	2	383	
9.196	6.6	203.7	7.13	3	383	
1879.191		205.43	7.120			

Σ. 1093.

$a = 7^h\ 21^m.2 \quad \delta = 50°\ 13'$ (9 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1880.044	4.9	126.7	0.86	2	606	
0.058	4.0	129.0	0.78	2	888	
1880.051		127.85	0.820			

O. Σ. 175.

$a = 7^h\ 26^m.8 \quad \delta = 31°\ 13'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.231	7.2	333 6	0.58	3	888	
1880.058	5.0	330.5	0.74	2	606	Images blurred.
1880.129	5.8	330.8	0.58	3	888	
1879.756		331.86	0.612			

Castor = Σ. 1110.

$\alpha = 7^h\ 26^m.9 \quad \delta = 32°\ 9'$ (2 and 3).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1878.235	8.3	237.2	5.83	3	383	Clouds.
8.270	8.6	235.2	5.85	2	383	
8.309	9.5	235.5	5.85	2	383	
1879.108	5.7	233.4	5.70	2	383	
9.127	5.4	234.0	5.76	2	383	
9.174	6.6	232.6	5.65	2	383	Clouds.
9.196	5.5	231.7	5.65	2	383	
1878.774		234.23	5.756			

Procyon.

$\alpha = 7^h\ 33^m.0 \quad \delta = 5°\ 32'$.

The apparent variable proper motion of this star has led astronomers to make careful searches for close companions, and several such have been discovered. An account of these discoveries will be found in the *Astronomische Nachrichten*, No. 2080, and in the Proceedings of the American Academy of Arts and Sciences, Boston, Massachusetts, Vol. XI, p. 185.

I have never been able to see any of these companions that would stand the test of sliding and changing the eye-piece, turning the micrometer, &c., and am therefore doubtful of their existence. This is an interesting star for the powerful telescopes of the future.

Σ. 1126.

$\alpha = 7^h\ 33^m.7 \quad \delta = 5°\ 31'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.097	5.2	141.9	1.25	2	606	
9.108	6.2	141.2	1.22	3	383	
9.185	7.5	143.5	1.18	2	606	
1879.130		142.20	1.217			

O. Σ. 179.

$\alpha = 7^h\ 37^m.2 \quad \delta = 24°\ 41'$ (4 and 9).

1879.097	5.9	232.8	6.40	2	383	
9.108	6.0	232.7	6.49	3	383	
9.185	7.8	237.6	6.47	2	606	
1879.130		234.37	6.453			

Σ. 1136.

$a = 7^h\ 41^m.6 \qquad \delta = 65°\ 15'$ (7 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.281	10.1	238.9	9.24	2	383	
9.305	10.6	240.7	9.19	2	383	
1879.293		239.80	9.215			

ρ Argus.

$a = 7^h\ 46^m.2 \qquad \delta = -13°\ 33'$ (5 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.231	7.4	297.3	0.43	2	888	Uncertain.
1880.129	6.6	315.1	0.34	2	888	Doubtful.
1879.680		306.2	0.385			

Σ. 1187.

$a = 8^h\ 1^m.9 \qquad \delta = 32°\ 35'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.097	6.2	48.1	1.91	3	383	
9.108	6.4	48.2	2.03	3	383	
9.190	7.3	53.5	1.82	2	383	Hazy.
9.196	6.8	50.4	2.02	3	383	
1879.148		50.05	1.945			

ζ Cancri = Σ. 1196. *A* and *B*.

$a = 8^h\ 5^m.3 \qquad \delta = 18°\ 1'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.311	9.9	104.0	0.68	2	606	
8.317	10.4	101.7	1.02	2	383	
8.328	10.3	101.2	0.74	2	383	
1878.319		102.30	0.813			

ζ Cancri. $\frac{A+B}{2}$ and *C*. (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.311	10.0	131.4	5.44	2	606	
8.317	10.6	128.9	5.42	2	383	
8.328	10.4	131.0	5.23	2	383	
1878.319		130.43	5.363			

φ^2 Cancri = Σ. 1223.

$\alpha = 8^h\ 19^m.5 \quad \delta = 27°\ 20'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1878.311	10.4	216.1	4.98	3	383	
8.317	11.0	216.2	4.97	2	383	Images blurred.
8.328	10.8	216.2	5.03	2	383	
1878.319		216.16	4.998			

υ' Cancri = Σ. 1224.

$\alpha = 8^h\ 19^m.6 \quad \delta = 24°\ 56'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.311	11.1	42.7	5.85	2	383	
8.317	11.4	42.9	5.93	2	383	
8.328	11.2	42.9	5.79	2	383	
1878.319		42.83	5.857			

Σ. 1263.

$\alpha = 8^h\ 37^m.3 \quad \delta = 42°\ 9'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.337	10.9	19.16	39.02	2	383	
	$\Delta\rho$	+ 0.01	+ 0.01			
		19.17	39.03			

ε Hydræ = Σ. 1273. *A* and *B*.

$\alpha = 8^h\ 40^m.4 \quad \delta = 6°\ 51'$ (4 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.330	9.9	224.8	3.38	3	383	
8.333	10.0	223.5	3.22	2	383	
8.336	10.2	225.2	3.35	2	383	
1878.333		224.50	3.317			

ε Hydræ. *A* and *C*. (4 and 14).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.330	10.2	193.9	19.78	3	383	14th mag.; *C* visible in twilight.

O. Σ. 196.

$\alpha = 8^h\ 50^m.9 \quad \delta = 48°\ 30'$ (4 and 12).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.281	10.4	358.1	9.74	2	383	
9.305	10.8	356.5	9.49	2	383	
1879.293		357.30	9.615			

Σ. 1300.

$\alpha = 8^h\ 54^m.7 \qquad \delta = 15^\circ\ 44'$ (9 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.193	8.7	202.3	4.78	2	383	
9.196	8.2	201.3	4.85	2	383	
1879.194		201.80	4.815			

Σ. 1306.

$\alpha = 8^h\ 59^m.8 \qquad \delta = 67^\circ\ 37'$ (5 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.313	10.5	244.6	2.40	2	888	
9.319	9.6	243.6	2.43	3	888	
1879.316		244.10	2.415			

O. Σ. 197.

$\alpha = 9^h\ 3^m.3 \qquad \delta = 3^\circ\ 28'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.199	6.8	60.1	1.35	2	606	
9.212	8.2	61.1	1.33	3	383	
9.215	7.7	60.2	1.40	2	383	Images blurred.
1879.207		60.52	1.352			

Lalande 18231.

$\alpha = 9^h\ 8^m.8 \qquad \delta = 4^\circ\ 40'$ (9.5 and 10.5).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.296	10.6	67.1	1.96	3	383	
7.312	10.6	63.4	1.93	2	383	
1877.304		65.25	1.945			This star was discovered by S. W. BURNHAM.

Σ. 1329.

$\alpha = 9^h\ 9^m.6 \qquad \delta = -0^\circ\ 42'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.199	7.1	67.75	22.49	2	383	Hazy.
9.215	7.4	67.80	22.56	2	383	
1879.207		67.78	22.525			
	$\Delta\rho =$	0.00	+ 0.007			
		67.78	22.532			

[illegible] 1331.

[illegible] 1′ 50′ (8 and 8).

Date.				Wt.	Power.	Remarks.
[illegible]			[illegible]	2	888	
			[illegible]	2	888	
			[illegible]	3	606	
			[illegible]			

Σ. 1338.

$\alpha = 9^h\ 13^m.5 \quad \delta = 38°\ 42'$ (7 and 7).

[illegible]		151.2	1.62	3	383	
[illegible]		152.9	1.57	2	383	
[illegible]		149.8	1.54	2	383	
		151.30	1.577			

Burnham 105.

$\alpha = 9^h\ 16^m.0 \quad \delta = 26°\ 30'$ (5 and 11).

[illegible]	[illegible]	204.4	2.87	3	383	
[illegible]	[illegible]	203.2	2.90	2	383	
[illegible]		203.80	2.885			

O. Σ. 200.

$\alpha = 9^h\ 16^m.6 \quad \delta = 52°\ 5'$ (6 and 8).

[illegible]	11.4	336.9	1.53	3	383	
[illegible]	10.5	340.4	1.47	3	383	
[illegible]	12.5	338.8	1.30	3	383	
[illegible]		338.70	1.433			

O. Σ. 201.

$\alpha = 9^h\ 16^m.8 \quad \delta = 28°\ 26'$ (7 and 11).

[illegible]	12.9	229.1	1.28	3	383	
[illegible]	12.5	227.3	1.31	2	383	
[illegible]		228.20	1.295			

Σ. 1348.

$= 9^h\ 18^m.2 \quad \delta = 6^\circ\ 49'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.212	8.5	325.2	1.68	2	383	
9.215	9.5	327.6	1.68	2	383	
9.220	7.4	324.2	1.47	2	383	Blurred images.
1879.215		325.96	1.638			

Σ. 1355.

$a = 9^h\ 21^m.2 \quad \delta = 6^\circ\ 48'$ (7 and 7).

1878.350	11.0	328.1	2.78	3	383	
8.355	11.4	331.0	2.80	2	383	
9.215	9.2	153.6	2.60	3	383	
9.220	7.6	332.3	2.74	2	383	
1878.785		331.25	2.730			

ω Leonis.

$a = 9^h\ 22^m.0 \quad \delta = 9^\circ\ 35'$ (6 and 7).

1878.336	10.5	73.8	0.46	2	888	
8.350	10.7	78.0	0.46	2	888	
9.231	6.8	70.5	0.41	3	888	
9.253	7.7	74.1	0.36	3	888	
9.256	8.1	75.6	0.42	2	888	Windy.
9.264	7.9	74.3	0.38	3	888	
1878.948		74.38	0.415			

O. Σ. 205.

$a = 9^h\ 35^m.0 \quad \delta = 41^\circ\ 31'$ (8 and 10).

1879.229	8.1	199.4	11.88	2	383	Comp. 14th mag.
9.231	. .	199.2	11.86	3	383	
1879.230		199.30	11.870			

Σ. 1377.

$a = 9^h\ 37^m.2 \quad \delta = 3^\circ\ 11'$ (8 and 11).

1879.327	10.2	139.7	3.79	2	383	
9.330	10.4	140.3	3.71	2	383	Very unsteady.
1879.328		140.00	3.750			

Σ. 1331.

$\alpha = 9^h\ 11^m.5$ $\delta = 61°\ 50'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.314	10.8	153.9	0.94	2	888	
9.319	9.9	154.6	0.83	2	888	
9.393	12.2	152.2	0.86	3	606	
1879.342		153.57	0.877			

Σ. 1338.

$\alpha = 9^h\ 13^m.5$ $\delta = 38°\ 42'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.212	7.9	151.2	1.62	3	383	
9.215	7.1	152.9	1.57	2	383	
9.220	7.1	149.8	1.54	2	383	
1879.216		151.30	1.577			

Burnham 105.

$\alpha = 9^h\ 16^m.0$ $\delta = 26°\ 30'$ (5 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.330	10.6	204.4	2.87	3	383	
8.333	10.4	203.2	2.90	2	383	
1878.332		203.80	2.885			

O. Σ. 200.

$\alpha = 9^h\ 16^m.6$ $\delta = 52°\ 5'$ (6 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.313	11.4	336.9	1.53	3	383	
9.319	10.5	340.4	1.47	3	383	
9.393	12.5	338.8	1.30	3	383	
1879.342		338.70	1.433			

O. Σ. 201.

$\alpha = 9^h\ 16^m.8$ $\delta = 28°\ 26'$ (7 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.385	12.0	229.1	1.28	3	383	
9.387	12.5	227.3	1.31	2	383	
1879.386		228.20	1.295			

Σ. 1348.

$= 9^h\ 18^m.2 \quad \delta = 6°\ 49'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.212	8.5	325.2	1.68	2	383	
9.215	9.5	327.6	1.68	2	383	
9.220	7.4	324.2	1.47	2	383	Blurred images.
1879.215		325.96	1.638			

Σ. 1355.

$\alpha = 9^h\ 21^m.2 \quad \delta = 6°\ 48'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.350	11.0	328.1	2.78	3	383	
8.355	11.4	331.0	2.80	2	383	
9.215	9.2	153.6	2.60	3	383	
9.220	7.6	332.3	2.74	2	383	
1878.785		331.25	2.730			

ω Leonis.

$\alpha = 9^h\ 22^m.0 \quad \delta = 9°\ 35'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.336	10.5	73.8	0.46	2	888	
8.350	10.7	78.0	0.46	2	888	
9.231	6.8	70.5	0.41	3	888	
9.253	7.7	74.1	0.36	3	888	
9.256	8.1	75.6	0.42	2	888	Windy.
9.264	7.9	74.3	0.38	3	888	
1878.948		74.38	0.415			

O. Σ. 205.

$\alpha = 9^h\ 35^m.0 \quad \delta = 41°\ 31'$ (8 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.229	8.1	199.4	11.88	2	383	Comp. 14th mag.
9.231	. .	199.2	11.86	3	383	
1879.230		199.30	11.870			

Σ. 1377.

$\alpha = 9^h\ 37^m.2 \quad \delta = 3°\ 11'$ (8 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.327	10.2	139.7	3.79	2	383	
9.330	10.4	140.3	3.71	2	383	Very unsteady.
1879.328		140.00	3.750			

Σ. 1389.

$\alpha = 9^h\ 45.^m5 \quad \delta = 27°\ 33'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.229	8.4	316.0	2.07	2	383	
9.231	8.0	315.6	2.07	3	383	
9.248	8.2	317.2	2.06	2	383	Very windy.
1879.236		316.27	2.067			

Σ. 1386.

$\alpha = 9^h\ 45^m.6 \quad \delta = 69°\ 28'$ (8 and 8).

1879.338	10.7	292.6	1.84	2	383	Cloudy.
9.393	12.8	114.8	1.80	3	383	
9.396	12.4	294.8	2.00	2	383	Images blurred.
1879.372		293.92	1.856			

8 Sextantis.

$\alpha = 9^h\ 46^m.6 \quad \delta = -7°\ 32'$ (5 and 6).

1879.231	8.3	297.5	0.31	1	888	Observations uncertain.
9.264	8.1	. .	. .	3	888	Not seen double.

Σ. 1400.

$\alpha = 9^h\ 53^m.0 \quad \delta = 69°\ 23'$ (7 and 10).

1879.313	11.7	227.7	2.39	3	383	Mags. 8th and 11th.
9.338	11.1	227.5	. .	2	383	Clouds.
9.393	13.1	224.7	2.59	2	383	Mags. 8th and 12th.
1879.348		226.63	2.490			This star was observed by mistake for Σ 1386.

A Leonis.

$\alpha = 10^h\ 1^m.5 \quad \delta = 10°\ 35'$ (5 and 15).

1876.359	. .	39.5	. .	2	383	Very faint; ½ wt.
6.362	. .	43.8	7.48	3	383	15th mag.
9.220	9.8	44.8	8.04	2	383	
9.231	8.6	44.4	8.14	3	383	
9.385	12.3	42.0	8.12	3	383	This companion was discovered by G. Anderson, April 22, 1876. It is a 15th or 16th magnitude star.
1878.306		43.28	7.945			

α Leonis, Comp.

$\alpha = 10^h\ 2^m.0 \quad \delta = 12°\ 33'$ (8 and 14).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1876.244	. .	86.0	. .	3	383	Clouds; 15th mag.
6.250	. .	87.8	3.25	2	383	15th–16th mag.
6.307	. .	83.2	3.14	3	383	Comp. well seen; 14th–15th.
9.220	10.2	92.9	3.70	2	383	
9.231	8.8	85.1	3.52	3	383	
9.270	8.7	83.5	3.56	3	383	This companion was discovered by Professor WINLOCK with the 15-inch refractor of the Harvard College Observatory. It is about the 15th magnitude.
1877.754		86.42	3.434			

O. Σ. 215.

$\alpha = 10^h\ 9^m.8 \quad \delta = 18°\ 20'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.231	9.3	222.0	0.64	2	888	
9.253	8.6	220.2	0.61	3	606	
9.264	8.3	222.9	0.64	3	888	
1879.249		221.70	0.630			

39 Leonis.

$\alpha = 10^h\ 10^m.7 \quad \delta = 23°\ 42'$ (6 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.336	10.8	299.9	7.02	3	383	
9.264	8.6	299.9	7.11	3	383	
9.270	8.4	300.8	7.18	3	383	
1878.957		300.20	7.103			

γ Leonis.

$\alpha = 10^h\ 13^m.3 \quad \delta = 20°\ 27'$ (3 and 4).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.312	10.9	111.5	3.54	1	383	Extremely poor images.
7.408	12.5	111.8	3.75	2	383	
8.350	11.4	112.9	3.40	2	383	
8.380	11.2	112.4	3.48	2	383	
8.391	11.9	110.2	3.57	2	383	Images blazing.
9.231	9.5	116.4	3.52	2	888	Images blazing.
9.253	8.9	115.7	3.58	2	383	
9.256	8.4	112.8	3.59	2	383	Windy.
9.264	8.8	114.7	3.35	3	383	
9.270	8.0	115.5	3.44	2	383	The observations of this star were generally made with difficulty, since the images were nearly always blazing and unsteady.
1878.612		113.39	3.522			

Σ. 1426. *A* and *B*.

$a = 10^h\ 14^m.2 \quad \delta = 7°\ 2'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1876.362	. .	276.3	0.72	3	383	
6.367	. .	277.6	0.60	2	606	
1876.364		276.95	0.660			

$\frac{A+B}{2}$ and *C*. (7 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.362	. .	9.3	7.81	3	383	
6.367	. .	10.5	8.03	2	383	
1876.364		9.90	7.920			

$\frac{A+B}{2}$ and *D*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.362	. .	45.2	34.39	3	383	*D* is 15th mag.

Σ. 1428.

$a = 10^h\ 18^m.4 \quad \delta = 53°\ 14'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.393	13.5	86.7	3.56	2	383	
9.434	13.0	87.3	3.56	3	383	
1879.414		87.00	3.560			

Σ. 1429.

$a = 10^h\ 18^m.4 \quad \delta = 25°\ 12'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.327	10.5	81.7	0.89	3	383	
9.333	10.3	82.3	0.87	3	383	
1879.330		82.00	0.880			

Σ. 1439.

$a = 10^h\ 23^m.7 \quad \delta = 21°\ 24'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.229	8.8	121.3	1.80	2	383	
9.231	9.0	121.8	1.79	3	383	
9.253	8.0	121.0	1.95	3	606	Clock going badly.
1879.238		121.37	1.847			

Σ. 1450.

$\alpha = 10^h\ 28^m.7 \qquad \delta = 9^\circ\ 17'$ (6 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1878.328	11.6	159.8	2.44	2	383	
8.330	11.9	159.8	2.36	3	383	
1878.329		159.80	2.400			

Σ. 1457.

$\alpha = 10^h\ 32^m.5 \qquad \delta = 6^\circ\ 22'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.333	11.6	310.2	1.13	2	606	
8.336	11.8	312.6	1.19	2	383	
1878.334		311.40	1.160			

O. Σ. 228.

$\alpha = 10^h\ 40^m.7 \qquad \delta = 23^\circ\ 12'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.327	10.8	196.1	0.30	3	888	
9.385	12.8	189.9	0.35	2	888	
9.406	12.4	198.4	0.37	2	888	
1879.373		194.80	0.340			

O. Σ. 229.

$\alpha = 10^h\ 41^m.1 \qquad \delta = 41^\circ\ 44'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.264	9.1	331.4	0.79	3	606	
9.278	9.2	330.6	0.77	2	606	Blurred images.
9.333	10.0	333.1	0.71	2	606	
1879.294		331.92	0.754			

Σ. 1487.

$\alpha = 10^h\ 49^m.1 \qquad \delta = 25^\circ\ 25'$ (5 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.231	9.8	106.9	6.44	3	383	
9.253	9.2	107.6	6.30	2	383	
9.256	8.7	107.0	6.58	2	383	Windy; difficult to observe.
1879.245		107.20	6.412			

Σ. 1500.

$\alpha = 10^h\ 53^m.9 \quad \delta = -2°\ 50'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1878.350	12.0	312.5	1.40	3	606	
8.355	11.7	315.0	1.32	2	383	
1878.352		313.75	1.360			

Σ. 1504.

$\alpha = 10^h\ 57^m.8 \quad \delta = 4°\ 17'$ (8 and 8).

1878.330	12.2	105.1	1.11	3	383	
8.333	10.8	102.9	1.15	2	383	
1878.332		104.00	1.130			

Σ. 1517.

$\alpha = 11^h\ 7^m.4 \quad \delta = 20°\ 47'$ (7 and 7).

1876.395	. .	100.8	0.53	3	888	Mags. 9 and 9.5.
6.398	. .	96.8	0.48	3	888	
1876.396		98.80	0.505			This star was rediscovered by Mr. A. G. CLARK April 21, 1876.

Σ 1516. *A* and *B*.

$\alpha = 11^h\ 7^m.6 \quad \delta = 74°\ 7'$ (7 and 8).

1879.393	14.0	91.8	10.37	3	383	
9.434	13.3	92.3	10.64	3	383	
1879.414		92.05	10.505			
	$\Delta\rho =$	− 0.03	+ 0.004			
		92.02	10.509			

A and *C*. (7 and 13).

1879.393	14.1	298.5	7.56	2	383	*C* is 13th mag.
9.434	13.5	297.9	7.76	3	383	
1879.414		298.20	7.660			

ξ Ursæ Majoris.

$\alpha = 11^h\ 11^m.8 \quad \delta = 32°\ 13' \quad$ (4 and 5).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1877.408	13.4	294.5	. .	1	383	Images extremely poor.
7.410	14.5	294.4	2.10	2	383	Blazing images.
9.253	9.6	283.7	1.94	2	383	Blurred images.
9.264	9.3	283.8	1.77	3	606	
9.270	10.3	283.7	1.71	3	383	
9.278	9.5	285.1	1.98	2	383	Blurred images.
1878.802		286.59	1.854			

ι Leonis.

$\alpha = 11^h\ 17^m.6 \quad \delta = 11°\ 12' \quad$ (4 and 8).

1876.387	. .	70.3	2.73	3	383	
6.398	. .	69.4	2.81	3	606	
9.264	9.5	66.4	2.65	2	606	
9.278	8.7	68.0	2.81	2	383	
1877.832		68.52	2.750			

57 Ursæ Majoris.

$\alpha = 11^h\ 22^m.6 \quad \delta = 40°\ 0' \quad$ (6 and 8).

1877.408	13.6	183.5	5.60	2	383	
7.410	14.8	1.3	5.35	2	383	
1877.409		2.40	5.475			

O. Σ. 235.

$\alpha = 11^h\ 25^m.4 \quad \delta = 61°\ 45' \quad$ (6 and 8).

1879.434	13.8	54.6	1.12	3	888	
9.439	13.1	57.1	1.01	3	888	
9.450	13.9	54.8	1.07	2	888	
1879.441		55.50	1.067			

Σ. 1555.

$\alpha = 11^h\ 30^m.0 \quad \delta = 28°\ 27' \quad$ (6 and 6).

1879.327	11.2	166.8	0.60	2	888	
9.333	10.5	162.0	0.76	2	383	
1879.330		164.40	0.680			

Lalande 22020.

$\alpha = 11^h\ 30^m.8 \quad \delta = -11^\circ\ 41$ (10 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	″				
1877.334	11.8	67.9	0.70	2	606	10th mag.
7.364	11.1	68.5	0.59	2	606	Both 10th mag.
1877.349		68.20	0.645			This star was discovered by S. W. Burnham.

O. Σ. 237.

$\alpha = 11^h\ 32^m.5 \quad \delta = 41^\circ\ 49'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.385	13.4	272.1	1.16	2	606	
9.387	12.8	272.6	0.95	2	383	
9.390	11.9	269.6	0.99	2	606	
1879.387		271.43	1.033			

Oeltzen — Arg. 11836.

$\alpha = 11^h\ 55^m.5 \quad \delta = -20^\circ\ 53'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.364	11.4	84.9	0.84	2	606	
7.369	11.4	83.6	0.94	2	606	
1877.366		84.25	0.890			This star was discovered by S. W. Burnham.

Σ. 1594.

$\alpha = 11^h\ 57^m.3 \quad \delta = 42^\circ\ 3'$ (9 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.387	13.2	160.6	15.48	2	383	
9.434	14.0	160.4	15.42	3	383	
1879.410		160.50	15.450			
	$\Delta\rho =$	0.00	+ 0.004			
		160.50	15.454			A companion following; ($p = 90^\circ$, $s = 20''$, by est.) and of 13th mag.

Σ. 1606.

$\alpha = 12^h\ 4^m.7 \quad \delta = 40^\circ\ 34'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.327	11.6	341.4	1.28	2	606	
9.333	10.8	339.2	1.12	2	383	
1879.330		340.30	1.200			

$O. \Sigma.$ 249. A and B.

$\alpha = 12^h\ 18^m.1 \quad \delta = 54^\circ\ 49'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.393	14.5	312.2	0.43	2	888	
9.439	13.3	309.4	0.44	3	888	
1879.416		311.80	0.435			

$\frac{A+B}{2}$ and C. (7 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.393	14.7	148.6	13.35	2	383	
9.439	13.5	149.7	13.18	3	383	C is 13th mag.
1879.416		149.15	13.265			
	$\Delta\rho$	− 0.01	+ 0.005			
		149.14	13.270			

Lalande 23271.

$\alpha = 12^h\ 20^m.5 \quad \delta = 0^\circ\ 30'$ (8 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.419	12.6	236.8	0.99	2	606	
6.433	. .	232.0	0.78	2	606	
6.439	13.2	232.2	0.77	3	606	
1876.430		233.67	0.847			This star was discovered by A. G. CLARK.

Σ. 1647.

$\alpha = 12^h\ 24^m.5 \quad \delta = 10^\circ\ 23'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.362	. .	214.1	1.33	2	383	Mags. 9 and 9½.
6.398	. .	215.8	1.19	3	606	
6.406	. .	220.3	1.28	3	{ 383 p / 606 s }	
9.319	11.6	219.8	1.26	3	383	
9.333	11.3	219.5	1.22	2	383	
9.387	13.8	219.3	1.16	2	383	Images blurred.
1876.389		216.73	1.267			
1879.338		219.58	1.224			

Σ. 1331.

$\alpha = 9^h\ 11^m.5 \quad \delta = 61°\ 50'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.314	10.8	153.9	0.94	2	888	
9.319	9.9	154.6	0.83	2	888	
9.393	12.2	152.2	0.86	3	606	
1879.342		153.57	0.877			

Σ. 1338.

$\alpha = 9^h\ 13^m.5 \quad \delta = 38°\ 42'$ (7 and 7).

1879.212	7.9	151.2	1.62	3	383	
9.215	7.1	152.9	1.57	2	383	
9.220	7.1	149.8	1.54	2	383	
1879.216		151.30	1.577			

Burnham 105.

$\alpha = 9^h\ 16^m.0 \quad \delta = 26°\ 30'$ (5 and 11).

1878.330	10.6	204.4	2.87	3	383	
8.333	10.4	203.2	2.90	2	383	
1878.332		203.80	2.885			

O. Σ. 200.

$\alpha = 9^h\ 16^m.6 \quad \delta = 52°\ 5'$ (6 and 8).

1879.313	11.4	336.9	1.53	3	383	
9.319	10.5	340.4	1.47	3	383	
9.393	12.5	338.8	1.30	3	383	
1879.342		338.70	1.433			

O. Σ. 201.

$\alpha = 9^h\ 16^m.8 \quad \delta = 28°\ 26'$ (7 and 11).

1879.385	12.0	229.1	1.28	3	383	
9.387	12.5	227.3	1.31	2	383	
1879.386		228.20	1.295			

Σ. 1348.

$= 9^h\ 18^m.2 \quad \delta = 6°\ 49'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.212	8.5	325.2	1.68	2	383	
9.215	9.5	327.6	1.68	2	383	
9.220	7.4	324.2	1.47	2	383	Blurred images.
1879.215		325.96	1.638			

Σ. 1355.

$\alpha = 9^h\ 21^m.2 \quad \delta = 6°\ 48'$ (7 and 7).

1878.350	11.0	328.1	2.78	3	383	
8.355	11.4	331.0	2.80	2	383	
9.215	9.2	153.6	2.60	3	383	
9.220	7.6	332.3	2.74	2	383	
1878.785		331.25	2.730			

ω Leonis.

$\alpha = 9^h\ 22^m.0 \quad \delta = 9°\ 35'$ (6 and 7).

1878.336	10.5	73.8	0.46	2	888	
8.350	10.7	78.0	0.46	2	888	
9.231	6.8	70.5	0.41	3	888	
9.253	7.7	74.1	0.36	3	888	
9.256	8.1	75.6	0.42	2	888	Windy.
9.264	7.9	74.3	0.38	3	888	
1878.948		74.38	0.415			

O. Σ. 205.

$\alpha = 9^h\ 35^m.0 \quad \delta = 41°\ 31'$ (8 and 10).

1879.229	8.1	199.4	11.88	2	383	Comp. 14th mag.
9.231	. .	199.2	11.86	3	383	
1879.230		199.30	11.870			

Σ. 1377.

$\alpha = 9^h\ 37^m.2 \quad \delta = 3°\ 11'$ (8 and 11).

1879.327	10.2	139.7	3.79	2	383	
9.330	10.4	140.3	3.71	2	383	Very unsteady.
1879.328		140.00	3.750			

Σ. 1389.

$\alpha = 9^h\ 45.^m5$ $\delta = 27°\ 33'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.229	8.4	316.0	2.07	2	383	
9.231	8.0	315.6	2.07	3	383	
9.248	8.2	317.2	2.06	2	383	Very windy.
1879.236		316.27	2.067			

Σ. 1386.

$\alpha = 9^h\ 45^m.6$ $\delta = 69°\ 28'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.338	10.7	292.6	1.84	2	383	Cloudy.
9.393	12.8	114.8	1.80	3	383	
9.396	12.4	294.8	2.00	2	383	Images blurred.
1879.372		293.92	1.856			

8 Sextantis.

$\alpha = 9^h\ 46^m.6$ $\delta = -7°\ 32'$ (5 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.231	8.3	297.5	0.31	1	888	Observations uncertain.
9.264	8.1	. .	. .	3	888	Not seen double.

Σ. 1400.

$\alpha = 9^h\ 53^m.0$ $\delta = 69°\ 23'$ (7 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.313	11.7	227.7	2.39	3	383	Mags. 8th and 11th.
9.338	11.1	227.5	. .	2	383	Clouds.
9.393	13.1	224.7	2.59	2	383	Mags. 8th and 12th.
1879.348		226.63	2.490			This star was observed by mistake for Σ 1386.

A Leonis.

$\alpha = 10^h\ 1^m.5$ $\delta = 10°\ 35'$ (5 and 15).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.359	. .	39.5	. .	2	383	Very faint; ½ wt.
6.362	. .	43.8	7.48	3	383	15th mag.
9.220	9.8	44.8	8.04	2	383	
9.231	8.6	44.4	8.14	3	383	
9.385	12.3	42.0	8.12	3	383	This companion was discovered by G. ANDERSON, April 22, 1876. It is a 15th or 16th magnitude star.
1878.306		43.28	7.945			

α Leonis, Comp.

α = 10ʰ 2ᵐ.0 δ = 12° 33′ (8 and 14).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1876.244	. .	86.0	. .	3	383	Clouds; 15th mag.
6.250	. .	87.8	3.25	2	383	15th–16th mag.
6.307	. .	83.2	3.14	3	383	Comp. well seen; 14th–15th.
9.220	10.2	92.9	3.70	2	383	
9.231	8.8	85.1	3.52	3	383	
9.270	8.7	83.5	3.56	3	383	
1877.754		86.42	3.434			This companion was discovered by Professor WINLOCK with the 15-inch refractor of the Harvard College Observatory. It is about the 15th magnitude.

O. Σ. 215.

α = 10ʰ 9ᵐ.8 δ = 18° 20′ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.231	9.3	222.0	0.64	2	888	
9.253	8.6	220.2	0.61	3	606	
9.264	8.3	222.9	0.64	3	888	
1879.249		221.70	0.630			

39 Leonis.

α = 10ʰ 10ᵐ.7 δ = 23° 42′ (6 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.336	10.8	299.9	7.02	3	383	
9.264	8.6	299.9	7.11	3	383	
9.270	8.4	300.8	7.18	3	383	
1878.957		300.20	7.103			

γ Leonis.

α = 10ʰ 13ᵐ.3 δ = 20° 27′ (3 and 4).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.312	10.9	111.5	3.54	1	383	Extremely poor images.
7.408	12.5	111.8	3.75	2	383	
8.350	11.4	112.9	3.40	2	383	
8.380	11.2	112.4	3.48	2	383	
8.391	11.9	110.2	3.57	2	383	Images blazing.
9.231	9.5	116.4	3.52	2	888	Images blazing.
9.253	8.9	115.7	3.58	2	383	
9.256	8.4	112.8	3.59	2	383	Windy.
9.264	8.8	114.7	3.35	3	383	
9.270	8.0	115.5	3.44	2	383	
1878.612		113.39	3.522			The observations of this star were generally made with difficulty, since the images were nearly always blazing and unsteady.

Σ. 1426. *A* and *B*.

$\alpha = 10^h\ 14^m.2 \quad \delta = 7°\ 2'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1876.362	. .	276.3	0.72	3	383	
6.367	. .	277.6	0.60	2	606	
1876.364		276.95	0.660			

$\frac{A+B}{2}$ and C. (7 and 10).

1876.362	. .	9.3	7.81	3	383	
6.367	. .	10.5	8.03	2	383	
1876.364		9.90	7.920			

$\frac{A+B}{2}$ and D.

1876.362	. .	45.2	34.39	3	383	*D* is 15th mag.

Σ. 1428.

$\alpha = 10^h\ 18^m.4 \quad \delta = 53°\ 14'$ (7 and 8).

1879.393	13.5	86.7	3.56	2	383	
9.434	13.0	87.3	3.56	3	383	
1879.414		87.00	3.560			

Σ. 1429.

$\alpha = 10^h\ 18^m.4 \quad \delta = 25°\ 12'$ (8 and 8).

1879.327	10.5	81.7	0.89	3	383	
9.333	10.3	82.3	0.87	3	383	
1879.330		82.00	0.880			

Σ. 1439.

$\alpha = 10^h\ 23^m.7 \quad \delta = 21°\ 24'$ (8 and 9).

1879.229	8.8	121.3	1.80	2	383	
9.231	9.0	121.8	1.79	3	383	
9.253	8.0	121.0	1.95	3	606	Clock going badly.
187).238		121.37	1.847			

Σ. 1450.

$\alpha = 10^h\ 28^m.7 \quad \delta = 9°\ 17'$ (6 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1878.328	11.6	159.8	2.44	2	383	
8.330	11.9	159.8	2.36	3	383	
1878.329		159.80	2.400			

Σ. 1457.

$\alpha = 10^h\ 32^m.5 \quad \delta = 6°\ 22'$ (7 and 9).

1878.333	11.6	310.2	1.13	2	606	
8.336	11.8	312.6	1.19	2	383	
1878.334		311.40	1.160			

O. Σ. 228.

$\alpha = 10^h\ 40^m.7 \quad \delta = 23°\ 12'$ (7 and 8).

1879.327	10.8	196.1	0.30	3	888	
9.385	12.8	189.9	0.35	2	888	
9.406	12.4	198.4	0.37	2	888	
1879.373		194.80	0.340			

O. Σ. 229.

$\alpha = 10^h\ 41^m.1 \quad \delta = 41°\ 44'$ (6 and 7).

1879.264	9.1	331.4	0.79	3	606	
9.278	9.2	330.6	0.77	2	606	Blurred images.
9.333	10.0	333.1	0.71	2	606	
1879.294		331.92	0.754			

Σ. 1487.

$\alpha = 10^h\ 49^m.1 \quad \delta = 25°\ 25'$ (5 and 7).

1879.231	9.8	106.9	6.44	3	383	
9.253	9.2	107.6	6.30	2	383	
9.256	8.7	107.0	6.58	2	383	Windy; difficult to observe.
1879.245		107.20	6.412			

Σ. 1500.

$\alpha = 10^h\ 53^m.9$ $\delta = -2°\ 50'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1878.350	12.0	312.5	1.40	3	606	
8.355	11.7	315.0	1.32	2	383	
1878.352		313.75	1.360			

Σ. 1504.

$\alpha = 10^h\ 57^m.8$ $\delta = 4°\ 17'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.330	12.2	105.1	1.11	3	383	
8.333	10.8	102.9	1.15	2	383	
1878.332		104.00	1.130			

Σ. 1517.

$\alpha = 11^h\ 7^m.4$ $\delta = 20°\ 47'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.395	. .	100.8	0.53	3	888	Mags. 9 and 9.5.
6.398	. .	96.8	0.48	3	888	
1876.396		98.80	0.505			This star was rediscovered by Mr. A. G. CLARK April 21, 1876.

Σ 1516. *A* and *B*.

$\alpha = 11^h\ 7^m.6$ $\delta = 74°\ 7'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.393	14.0	91.8	10.37	3	383	
9.434	13.3	92.3	10.64	3	383	
1879.414		92.05	10.505			
	$\Delta\rho =$	− 0.03	+ 0.004			
		92.02	10.509			

A and *C*. (7 and 13).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.393	14.1	298.5	7.56	2	383	*C* is 13th mag.
9.434	13.5	297.9	7.76	3	383	
1879.414		298.20	7.660			

ξ Ursæ Majoris.

$\alpha = 11^h\ 11^m.8 \qquad \delta = 32°\ 13' \qquad$ (4 and 5).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1877.408	13.4	294.5	. .	1	383	Images extremely poor.
7.410	14.5	294.4	2.10	2	383	Blazing images.
9.253	9.6	283.7	1.94	2	383	Blurred images.
9.264	9.3	283.8	1.77	3	606	
9.270	10.3	283.7	1.71	3	383	
9.278	9.5	285.1	1.98	2	383	Blurred images.
1878.802		286.59	1.854			

ι Leonis.

$\alpha = 11^h\ 17^m.6 \qquad \delta = 11°\ 12' \qquad$ (4 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.387	. .	70.3	2.73	3	383	
6.398	. .	69.4	2.81	3	606	
9.264	9.5	66.4	2.65	2	606	
9.278	8.7	68.0	2.81	2	383	
1877.832		68.52	2.750			

57 Ursæ Majoris.

$\alpha = 11^h\ 22^m.6 \qquad \delta = 40°\ 0' \qquad$ (6 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.408	13.6	183.5	5.60	2	383	
7.410	14.8	1.3	5.35	2	383	
1877.409		2.40	5.475			

O. Σ. 235.

$\alpha = 11^h\ 25^m.4 \qquad \delta = 61°\ 45' \qquad$ (6 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.434	13.8	54.6	1.12	3	888	
9.439	13.1	57.1	1.01	3	888	
9.450	13.9	54.8	1.07	2	888	
1879.441		55.50	1.067			

Σ. 1555.

$\alpha = 11^h\ 30^m.0 \qquad \delta = 28°\ 27' \qquad$ (6 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.327	11.2	166.8	0.60	2	888	
9.333	10.5	162.0	0.76	2	383	
1879.330		164.40	0.680			

Lalande 22020.

$\alpha = 11^h\ 30^m.8 \quad \delta = -11°\ 41$ (10 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°				
1877.334	11.8	67.9	0.70	2	606	10th mag.
7.364	11.1	68.5	0.59	2	606	Both 10th mag.
1877.349		68.20	0.645			This star was discovered by S. W. Burnham.

O. Σ. 237.

$\alpha = 11^h\ 32^m.5 \quad \delta = 41°\ 49'$ (8 and 9).

1879.385	13.4	272.1	1.16	2	606	
9.387	12.8	272.6	0.95	2	383	
9.390	11.9	269.6	0.99	2	606	
1879.387		271.43	1.033			

Oeltzen — Arg. 11836.

$\alpha = 11^h\ 55^m.5 \quad \delta = -20°\ 53'$ (8 and 9).

1877.364	11.4	84.9	0.84	2	606	
7.369	11.4	83.6	0.94	2	606	
1877.366		84.25	0.890			This star was discovered by S. W. Burnham.

Σ. 1594.

$\alpha = 11^h\ 57^m.3 \quad \delta = 42°\ 3'$ (9 and 10).

1879.387	13.2	160.6	15.48	2	383	
9.434	14.0	160.4	15.42	3	383	
1879.410		160.50	15.450			
	$\Delta\rho =$	0.00	+ 0.004			
		160.50	15.454			A companion following; ($p = 90°$, $s = 20''$, by est.) and of 13th mag.

Σ. 1606.

$\alpha = 12^h\ 4^m.7 \quad \delta = 40°\ 34'$ (6 and 7).

1879.327	11.6	341.4	1.28	2	606	
9.333	10.8	339.2	1.12	2	383	
1879.330		340.30	1.200			

O. Σ 249. A and B.

$\alpha = 12^h\ 18^m.2 \qquad \delta = 54°\ 41' \qquad$ [illegible] and 8.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.393	14.5	322.2	2.43	2	383	
9.439	13.3	[illegible]	2.44	3	383	
1879.416		[illegible]	2.435			

$\dfrac{A+B}{2}$ and C. [illegible] and 11.

1879.393	14.7	145.6	13.35	2	383	
9.439	13.5	145.7	13.18	3	383	C is 13th mag.
1879.416		145.15	13.265			
	Δp	− [illegible]	+ 0.005			
		145.14	13.270			

Lalande 23271.

$\alpha = 12^h\ 20^m.5 \qquad \delta = 0°\ 30' \qquad$ 8 and 11.

1876.419	12.6	236.8	0.99	2	606	
6.433	. .	232.0	0.75	2	606	
6.439	13.2	232.2	0.77	3	606	
1876.430		233.67	0.847			This star was discovered by A. G. Clark.

Σ. 1647.

$\alpha = 12^h\ 24^m.5 \qquad \delta = 10°\ 23' \qquad$ 67 and 81.

1876.362	. .	214.1	1.33	2	383	Mags. 9 and 9½.
6.398	. .	215.8	1.19	3	606	
6.406	. .	220.3	1.28	3	383 p; 606 s	
9.319	11.6	219.8	1.26	3	383	
9.333	11.3	219.5	1.22	2	383	
9.387	13.8	219.3	1.16	2	383	Images blurred.
1876.389		216.73	1.267			
1879.338		219.58	1.224			

Σ. 1658.

$\alpha = 12^h\ 29^m.0 \quad \delta = 8°\ 7' \quad$ (9 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.333	11.6	352.5	2.30	2	383	
9.387	13.5	352.6	2.53	2	383	
9.396	13.4	354.0	2.26	3	383	
1879.372		353.03	2.363			

γ Virginis.

$\alpha = 12^h\ 35^m.6 \quad \delta = -0°\ 47' \quad$ (3 and 3).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.411	12.2	159.8	5.17	3	383	
6.417	12.7	159.9	5.24	2	383	Images blurred.
6.419	12.3	160.8	5.08	2	383	
6.422	12.3	160.3	5.12	2	383	
9.319	11.8	158.3	5.26	3	383	Clouds.
9.406	12.7	158.3	5.24	3	383	
9.409	12.3	158.4	5.09	3	383	
1876.417		160.24	5.140			
1879.378		158.33	5.197			

h 521.

$\alpha = 12^h\ 39^m.2 \quad \delta = 28°\ 3' \quad$ (7 and 14).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.363	. .	2.9	32.78	.	392	

Σ. 1687. *A* and *B*.

$\alpha = 12^h\ 47^m.4 \quad \delta = 21°\ 53' \quad$ (6 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.406	13.8	60.9	1.50	2	606	Images blurred.
9.409	12.8	66.2	1.41	3	606	
9.415	13.3	63.5	1.32	3	606	
9.417	13.0	60.2	1.31	2	383	
1879.413		62.96	1.369			

A and *C*. (6 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.406	14.0	125.3	28.84	2	383	
9.409	12.9	125.1	28.74	3	606	
9.417	13.2	125.0	28.78	3	383	
1879.411		125.13	28.787			
	$\Delta\rho =$	0.00	+ 0.008			
		125.13	28.795			

46 Virginis.

$\alpha = 12^h\ 54^m.4$ $\delta = -2°\ 43'$ (6 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1876.403	13.8	159.4	1.16	3	606	6th and 11th mag.
6.406	. .	157.7	1.56	3	383	s difficult; ½ wt.
6.417	13.0	159.8	1.26	3	383	
9.406	13.0	156.0	1.27	2	606	
9.409	12.5	152.6	1.35	3	606	
9.415	12.7	154.7	1.23	3	606	
1876.409		159.22	1.280			
1879.410		154.43	1.283			This star was discovered by A. G. CLARK. It is doubtful if the change in the angle is real.

42 Comæ Ber. = Σ. 1728.

$\alpha = 13^h\ 4^m.2$ $\delta = 18°\ 10'$ (6 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.381	. .	190.2	0.38	3	888	
6.403	14.2	194.3	0.42	3	888	
6.406	14.7	193.9	0.40	3	888	
6.417	13.3	195.2	0.42	3	888	
8.350	12.4	188.6	0.56	3	888	
8.380	11.6	190.2	0.47	2	888	
8.407	12.2	190.1	0.48	2	888	Very unsteady.
8.410	12.1	189.6	0.52	3	888	
9.409	13.2	192.9	0.52	3	888	
9.415	13.0	195.0	0.51	3	888	
9.417	13.4	193.9	0.49	3	888	
9.426	12.5	191.1	0.51	2	888	
1876.402		193.40	0.405			
1878.387		189.62	0.507			
1879.417		193.22	0.507			

ζ Ursæ Majoris.

$\alpha = 13^h\ 19^m.1$ $\delta = 55°\ 33'$ (3 and 4).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.397	15.1	148.9	14.59	2	383	
7.408	12.3	147.6	14.66	2	383	Images blazing.
7.411	15.1	148.4	14.74	2	383	
7.416	15.1	148.1	14.67	2	383	
7.421	14.3	148.5	14.48	3	383	
7.427	15.3	148.8	14.47	3	383	
1877.413		148.38	14.602			
	$\Delta\rho =$	0.00	+ 0.005			
		148.38	14.607			This star was photographed at Cambridge in 1857. See *Astronomische Nachrichten*, volumes 47, 48, and 49.

O. Σ. 266.

$\alpha = 13^h\ 22^m.5 \qquad \delta = 16°\ 22'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.396	13.8	337.8	1.43	2	383	
9.409	13.5	337.6	1.70	3	606	
9.417	13.7	338.1	1.45	3	383	
1879.407		337.83	1.527			

Σ. 1757.

$\alpha = 13^h\ 28^m.2 \qquad \delta = 0°\ 18'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.396	14.2	70.7	2.37	2	383	
9.406	14.4	67.1	2.30	2	383	
1879.401		68.90	2.335			

Σ. 1768.

$\alpha = 13^h\ 32^m.2 \qquad \delta = 36°\ 55'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.365	. .	. .	. .	.	392	Star single; images bad.
1876.419	. .	. .	. .	.	606 888	Image much blurred, and not certain that star is divided.
1879.415	13.5	(163.4)	(0.20) est.	2	888	Star seems elongated.
9.478	14.3	159.2	0.53	3	888	Well seen.
9.480	14.2	153.0	0.49	3	888	
9.500	14.7	159.9	0.48	2	888	Images blurred.
9.502	14.7	162.8	0.59	2	888	Images indistinct.
9.505	14.8	155.2	0.44	2	888	Images indistinct.
1879.489		157.47	0.507			

B. A. C. 4549.

$\alpha = 13^h\ 33^m.6 \qquad \delta = 11°\ 21'$ (6 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.410	13.8	62.8	0.33	2	888	Elongated only.
8.467	14.1	52.6	0.24	2	888	Difficult.
9.478	14.7	244.2	0.18	3	1282	
9.480	14.5	242.4	0.23	3	1282	
1878.959		60.50	0.245			

Σ. 1777.

$\alpha \quad 13^h\ 37^m.0 \qquad \delta = 4°\ 9'$ (6 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.406	14.7	228.7	3.43	2	383	
9.409	13.7	231.5	3.47	3	606	
1879.408		230.10	3.450			

86 Virginis. *A* and *B*.

$\alpha = 13^h\ 39^m.5$ $\delta = 11°\ 49'$ (6 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.480	14.8	291.9	1.60	3	383	
9.497	14.9	291.6	1.67	2	383	
9.500	15.1	295.1	1.46	2	606	
9.502	15.0	294.9	1.63	3	606	
9.530	15.5	294.2	1.70	3	383	
1879.502		293.54	1.612			

86 Virginis. *C* and *D*. (12 and 13).

1879.497	15.3	275.1	1.66	2	606	Images blurred.
9.502	15.2	277.1	1.94	2	606	Faint in moonlight.
1879.500		276.10	1.800			This star was discovered by S. W. BURNHAM. Both these observations were made in strong moonlight. Under these conditions the magnitudes were estimated 12 and 13.

Σ. 1781.

$\alpha = 13^h\ 40^m.2$ $\delta = 5°\ 43'$ (7 and 8).

1879.406	14.9	263.7	1.14	2	606	
9.409	13.9	262.5	1.12	3	606	
1879.408		263.10	1.130			

O. Σ. 270.

$\alpha = 13^h\ 41^m.6$ $\delta = 18°\ 4'$ (5 and 12).

1875.357	12.8	350.9	9.43	2	392	5th and 14th mags.

Σ. 1785.

$\alpha = 13^h\ 43^m.6$ $\delta = 27°\ 35'$ (7 and 8).

1879.409	14.2	212.9	2.06	3	606	
9.417	14.0	215.7	1.99	3	383	
9.426	12.8	215.0	2.06	3	606	
1879.417		214.53	2.037			

Σ. 1788.

$\alpha = 13^h\ 48^m.6$ δ $7°\ 28'$ (6 and 7).

1879.409	14.5	[illegible].0	2.68	3	383	
9.426	13.0	[illegible].0	2.59	2	606	
1879.418		[illegible]4.00	2.635			

Σ. 1813.

$\alpha = 14^h\ 7^m.4 \quad \delta = 5°\ 58'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1876.398	. .	193.5	4.99	3	383	
6.403	. .	192.8	4.88	3	606	
1876.400		193.15	4.935			

O. Σ. 278.

$\alpha = 14^h\ 7^m.5 \quad \delta = 44°\ 45'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.439	13.9	110.8	0.35	3	888	
9.453	13.5	110.5	0.34	3	888	
1879.446		110.65	0.345			

Σ. 1820.

$\alpha = 14^h\ 8^m.8 \quad \delta = 55°\ 53'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.439	14.2	67.6	2.23	3	383	
9.450	15.4	243.7	2.21	2	383	
9.453	13.8	68.5	2.18	4	383	
1879.447		66.60	2.207			

Σ. 1819.

$\alpha = 14^h\ 9^m.3 \quad \delta = 3°\ 42'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.403	15.0	201.7	1.25	3	606	
6.406	14.4	199.3	1.37	3	383	
6.417	13.6	199.4	1.15	3	383	
1876.409		200.13	1.257			

Σ. 1825.

$\alpha = 14^h\ 11^m.0 \quad \delta = 20°\ 41'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.409	14.7	175.2	4.13	3	383	
9.426	13.2	177.2	4.03	3	606	
1879.418		176.20	4.080			

Σ. 1830.

$\alpha = 14^h\ 11^m.9 \quad \delta = 57°\ 14'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.450	15.9	285.0	5.94	2	383	
9.453	14.0	285.8	5.93	4	383	
9.461	13.9	284.1	5.93	3	383	
1879.455		284.97	5.933			

Σ. 1831.

$\alpha = 14^h\ 12^m.4 \quad \delta = 57°\ 16'$ (6 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.450	15.7	140.4	6.15	2	383	
9.453	14.1	140.2	6.02	4	383	
9.461	13.8	138.7	5.98	3	383	
1879.455		139.77	6.050			

Σ. 1834.

$\alpha = 14^h\ 15^m.9 \quad \delta = 49°\ 4'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.464	14.2	114.0	0.49	3	888	
9.467	14.1	114.5	0.41	3	888	
9.469	14.0	116.0	0.47	3	888	
1879.467		114.83	0.457			

Σ. 1837.

$\alpha = 14^h\ 18^m.2 \quad \delta = -11°\ 7'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.409	15.0	306.4	1.25	3	606	
9.426	13.5	309.9	1.45	2	606	
9.480	15.5	307.1	1.44	2	383	
1879.438		307.80	1.380			

Σ. 1863.

$\alpha = 14^h\ 34^m.0 \quad \delta = 52°\ 9'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.439	14.4	94.3	0.60	3	888	
9.453	14.4	91.5	0.57	3	888	Hazy.
9.461	14.3	91.7	0.47	3	383	
1879.451		92.50	0.547			

Σ. 1864.

$a = 14^h\ 35^m.1$ $\delta = 16°\ 56'$ (5 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.426	13.8	100.6	6.09	2	606	
9.478	14.0	100.8	6.08	3	383	
9.480	15.3	100.7	5.93	3	383	
1879.461		100.70	6.033			

ζ Bootis = Σ. 1865.

$a = 14^h\ 35^m.4$ $\delta = 14°\ 15'$ (4 and 5).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.419	13.4	303.1	0.73	3	888	
6.439	13.7	305.2	0.75	3	606	
6.441	13.6	303.4	0.70	3	606	
8.410	12.8	118.2	0.56	3	888	
8.424	13.0	120.7	0.55	2	888	
9.426	14.1	300.6	0.51	2	888	
9.478	15.3	117.1	0.66	3	888	
9.480	15.8	115.8	0.67	2	888	
1876.433		303.90	0.727			
1879.044		298.48	0.590			

Σ. 1867.

$a = 14^h\ 35^m.6$ $\delta = 31°\ 49'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.455	14.4	16.8	1.39	3	383	
6.471	14.0	13.5	1.15	2	606	
6.480	14.5	17.2	1.20	4	383	
1876.469		15.83	1.247			

ε Bootis = Σ. 1877.

$a = 14^h\ 39^m.7$ $\delta = 27°\ 35'$ (3 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.419	13.7	328.6	2.94	3	606	
6.439	14.0	330.4	2.90	3	383	
6.441	14.0	327.2	3.09	2	383	
8.407	12.6	326.9	2.87	2	383	Unsteady images.
8.410	12.4	326.2	2.87	3	383	
9.426	14.4	328.7	2.98	3	383	
9.478	15.5	329.3	3.11	2	383	
9.480	16.1	327.5	2.77	2	606	
1878.063		328.10	2.941			

Σ. 1883.

$\alpha = 14^h\ 42^m.8 \quad \delta = 6°\ 25'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.426	14.7	75.9	0.55	3	888	
9.478	15.9	258.0	0.88	2	888	
9.480	16.3	257.6	0.76	2	606	
1879.461		257.17	0.730			

h 5489.

$\alpha = 14^h\ 45^m \quad \delta = 29°\ 7'$ (6 and 16).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.404	. .	207.6	55.78	2	392	Comp. excessively faint.
8.380	12.4	206.1	56.72	3	383	
1876.892		206.85	56.25			HERSCHEL's companion was not visible.

ξ Bootis = Σ. 1888.

$\alpha = 14^h\ 45^m.8 \quad \delta = 19°\ 36'$ (5 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.419	14.0	284.9	4.59	3	606	
6.439	14.4	280.6	4.67	3	383	
6.441	14.3	284.6	4.65	2	383	
8.410	13.1	276.4	4.29	3	383	
8.424	13.4	278.5	4.34	2	383	
9.502	15.7	274.3	4.23	3	383	
9.505	15.1	276.7	4.23	3	383	
9.519	15.1	275.6	4.12	2	383	
9.524	16.0	274.9	4.12	2	383	Cloudy.
9.530	15.2	276.9	4.21	3	383	
1876.433		283.37	4.637			
1878.417		277.45	4.315			
1879.516		275.68	4.182			

O. Σ. 288.

$\alpha = 14^h\ 47^m.8 \quad \delta = 16°\ 11'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.497	15.9	197.6	1.39	2	606	
9.500	16.1	198.4	1.23	2	606	
9.502	15.9	197.4	1.29	3	383	
1879.500		197.80	1.303			

P. 212.

$\alpha = 14^h\ 50^m.5$ $\delta = -20°\ 52'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.497	15.7	289.0	15.44	2	383	
9.500	15.4	289.7	15.34	3	383	
9.502	15.4	289.1	15.40	3	383	
1879.500		289.27	15.393			
	$\Delta\rho =$	− 0.01	+ 0.005			
		289.26	15.398			

2 Serpentis.

$\alpha = 14^h\ 55^m.7$ $\delta = 0°\ 21'$ (6 and 8).

1875, May 28. With power 392 the star appears oblong in $p = 15°$, but with 606 there is no trace of duplicity. A companion of 13th–14th mag. in $p = 220°$, and $s = 25''$, by estimation.

44 Bootis = Σ. 1909.

$\alpha = 14^h\ 59^m.9$ $\delta = 48°\ 7'$ (5 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.471	14.3	240.4	5.03	3	383	
6.480	14.7	240.6	5.02	3	383	
1876.476		240.50	5.025			

Σ. 1910.

$\alpha = 15^h\ 1^m.8$ $\delta = 9°\ 41'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.497	16.3	211.4	4.30	2	383	
9.500	16.4	212.1	4.24	2	383	
9.502	16.2	211.1	4.41	3	383	
1879.500		211.53	4.317			

Lalande 27579.

$\alpha = 15^h\ 2^m.9$ $\delta = 2°\ 9'$ (8 and 12).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.488	. .	38.0	3.92	3	383	
6.499	. .	36.6	. .	3	383	Clouds.
6.543	. .	35.6	4.01	2	383	
1876.510		36.73	3.965			This star was discovered by S. W. BURNHAM.

B. A. C. 5020.

$a = 15^h\ 8^m.5 \quad \delta = -27° 9' \quad$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1876.488	. .	161.1	1.47	3	383	
6.545	15.7	165.2	1.16	2	383	
1876.516		163.15	1.315			This star was discovered by S. W. BURNHAM.

Σ. 3091.

$a = 15^h\ 9^m.7 \quad \delta = -4° 26' \quad$ (8 and 14).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.406	. .	249.4	12.73	2	606	The principal star appeared single. There is another faint companion of 12th mag. in $p = 270°$, and $s = 30''$, by estimation.

Oeltzen Arg. S. 14417.

$a = 15^h\ 10^m.3 \quad \delta = -15° 9' \quad$ (9.5 and 12).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.559	16.4	303.3	10.36	3	383	This star was discovered by S. W. BURNHAM.

O. Σ. 295

$a = 15^h\ 10^m.4 \quad \delta = 37° 16' \quad$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.439	14.9	126.1	1.01	3	888	
9.453	14.7	127.9	0.93	3	888	
9.461	14.7	130.6	0.97	2	888	
1879.451		128.20	0.970			

Σ. 1925.

$a = 15^h\ 10^m.5 \quad \delta = -7° 50' \quad$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.502	16.4	10.9	4.86	3	383	
9.505	15.8	11.8	4.94	3	383	
9.519	15.4	11.6	4.88	2	383	
1879.509		11.43	4.893			

Σ. 1930.

$a = 15^h\ 13^m.2 \quad \delta = 2° 14' \quad$ (5 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.502	16.6	39.7	10.76	3	383	
9.505	16.2	40.0	10.72	3	383	
9.519	15.6	40.2	10.66	2	383	
1879.509		39.97	10.713			

Σ. 1932.

$a = 15^h\ 13^m.2$ $\delta = 27\ 18'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.505	15.4	125.2	1.09	3	606	
9.530	16.1	121.3	1.18	3	606	
9.532	15.3	120.2	1.04	2	606	
1879.522		122.22	1.103			

Σ. 1934.

$a = 15^h\ 13^m.2$ $\delta = 44°\ 14'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.464	15.1	214.3	6.65	3	383	
9.467	14.4	214.2	6.54	3	888	
1879.466		214.25	6.595			

6 Serpentis.

$a = 15^h\ 14^m.9$ $\delta = 1°\ 9'$ (4.5 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.404	. .	14.8	3.11	3	392	

η Coronæ Borealis = Σ. 1937.

$a = 15^h\ 18^m.3$ $\delta = 30°\ 43'$ (5 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.419	14.3	250.4	0.76	3	888	
6.441	14.7	250.3	0.86	2	606	
6.444	14.3	249.7	0.71	2	606	
6.455	14.8	251.7	0.75	3	606	
9.541	15.9	97.8	0.50	2	888	
9.543	15.7	99.6	0.48	3	888	
9.546	15.5	97.6	0.48	3	888	
9.549	15.8	99.8	0.48	3	888	
1876.440		70.52	0.770			
1879.545		98.70	0.485			

μ^2 Bootis = Σ. 1938.

$a = 15^h\ 20^m.0$ $\delta = 37°\ 46'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.419	14.6	146.5	0.78	3	888	
6.441	15.0	148.9	0.70	2	606	
6.444	14.5	143.0	0.72	3	606	
6.452	14.4	143.1	0.73	2	606	
9.541	16.2	132.8	0.73	3	888	

μ^2 **Bootis** = Σ. **1938**—Continued.

$\alpha = 15^h\ 20^m.0 \quad \delta = 37^\circ\ 46' \quad$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.543	15.9	134.6	0.74	2	888	
9.546	15.7	134.6	0.72	3	888	
9.549	16.1	131.3	0.73	3	888	Faint.
1876.439		145.38	0.732			
1879.545		133.32	0.730			

μ **Bootis** and mean of μ^2 **Bootis.**

$\alpha = 15^h\ 20^m.0 \quad \delta = 37^\circ\ 46' \quad$ (4 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.543	16.2	171.47	108.27	3	383	
9.546	15.9	171.56	108.40	4	383	
1879.544		171.515	108.335			
	$\Delta\rho$ =	+ 0.002	+ 0.030			
		171.517	108.365			

Σ. **1944.**

$\alpha = 15^h\ 21^m.8 \quad \delta = 6^\circ\ 31'. \quad$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.505	16.4	334.3	1.22	3	606	
9.530	16.4	333.6	1.20	3	606	
9.532	15.5	333.7	1.34	3	606	
1879.522		333.87	1.253			

O. Σ. **6.**

$\alpha = 15^h\ 22^m.3 \quad \delta = 44^\circ\ 26' \quad$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.461	15.0	313.1	1.73	2	606	
9.464	14.5	313.1	1.65	3	383	
9.467	14.6	315.3	1.67	3	888	
1879.464		313.83	1.683			

δ **Serpentis** = Σ. **1954.**

$\alpha = 15^h\ 29^m.1 \quad \delta = 10^\circ\ 57' \quad$ (3 and 4).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.417	15.0	189.7	3.46	3	383	
6.419	15.0	190.0	3.40	2	606	
6.439	14.7	190.3	3.61	2	383	Blurred images.

δ Serpentis = Σ. 1954—Continued.

$a = 15\ 29^m.1$ $\delta = 10°\ 57'$ (3 and 4).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.530	16.6	192.5	3.39	3	606	
9.532	15.7	190.0	3.42	2	606	
9.535	15.3	190.0	3.39	2	606	
1876.422		189.94	3.466			
1879.532		190.83	3.400			

Σ. 1957.

$a = 15^h\ 30^m.2$ $\delta = 13°\ 18'$ (8 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.530	16.9	162.4	1.35	3	606	
9.532	15.8	159.5	1.10	3	606	
9.535	15.7	158.9	1.14	3	606	
1879.532		160.27	1.197			

O. Σ. 298.

$a = 15^h\ 31^m.7$ $\delta = 40°\ 13'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.439	15.3	331.9	0.25	3	888	
9.461	15.4	334.4	0.27	2	1282	
9.464	14.8	340.3	0.29	2	1282	
9.467	15.1	333.5	0.23	3	1282	
1879.458		335.02	0.260			

ζ Coronæ Borealis = Σ. 1965.

$a = 15^h.34^m.9$ $\delta = 37°\ 2'$ (4 and 5).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.444	14.7	302.5	6.33	3	383	
6.452	15.0	302.5	6.24	2	383	
6.455	15.2	299.9	6.30	3	383	Observer, H. S. Pritchett.
9.467	14.8	301.8	6.24	3	383	
9.469	14.6	303.3	6.30	3	383	
9.472	14.6	301.3	6.23	3	383	
1878.261		302.28	6.268			

γ Coronæ Borealis = Σ. 1967.

$a = 15^h\ 37^m.7$ $\delta = 26°\ 40'$ (4 and 7).

Date.		Remarks.
1875.404	Single.	
6.455	Single.	
9.554	Single.	
9.584	Single.	

ε Cor. Bor.

$\alpha = 15^h\ 52^m.6 \qquad \delta = 27°\ 14' \qquad$ (4 and 12).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1876.406	14.9	347.6	2.05	3	383	4th and 12th mags.
6.417	15.3	353.4	2.14	1.5	606	Very difficult.
6.419	15.3	350.4	2.17	3	606	Comp. 12th mag.
7.378	16.0	355.1	2.34	2	606	
9.546	16.2	355.8	. .	3	383	Comp. 13th mag.
9.554	15.7	353.8	. .	2	606	
1877.620		352.68	2.175			This star was discovered by Mr. A. G. CLARK, May 3, 1876.

O. Σ. 303.

$\alpha = 15^h\ 55^m.3 \qquad \delta = 13°\ 37' \qquad$ (7 and 8).

1879.530	17.1	130.6	0.69	3	888	
9.532	16.0	137.0	0.64	2	888	
9.535	15.5	133.2	0.76	3	606	
1879.532		133.60	0.697			

ξ Scorpii. *A* and *B*.

$\alpha = 15^h\ 57^m.8 \qquad \delta = -11°\ 3' \qquad$ (5 and 5).

1876.471	14.7	2.5	1.23	3	383	
6.545	16.0	5.5	1.14	3	383	
6.548	16.1	3.6	1.05	2	383	
9.530	17.4	11.0	1.22	2	606	
9.535	16.0	8.9	1.06	2	606	
9.554	16.0	9.6	1.04	2	606	
1878.031		6.85	1.123			

$\frac{A+B}{2}$ and *C*. (5 and 8).

1876.472	15.0	65.7	7.27	3	383	Clouds.
6.548	16.3	68.9	7.33	2	383	
1876.510		67.30	7.300			

A and *C*.

1879.530	17.5	63.1	7.81	2	606	
9.535	16.1	64.8	7.72	2	606	
9.554	16.1	62.8	7.73	2	606	
1879.540		63.57	7.753			

β Scorpii.

$\alpha = 15^h\ 58^m.5$ $\delta = -19°\ 29'$ (2 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.587	16.6	97.3	0.85	3	383	Elongated only.

ν Scorpii. *A* and *B*.

$\alpha = 16^h\ 5^m.0$ $\delta = -19°\ 9'$ (4 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.587	16.2	5.3	0.74	3	606	

C and *D*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.406	. .	(42.2)	(2.61)	2	392	Rejected.
9.535	16.4	47.1	1.78	2	606	
9.554	16.4	45.4	2.20	2	383	
9.557	16.8	46.6	2.18	2	383	Clouds.
9.584	16.4	46.8	2.15	3	606	
1879.557		46.48	2.078			

49 Serpentis = Σ. 2021.

$\alpha = 16^h\ 7^m.7$ $\delta = 13°\ 51'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.452	15.3	329.0	3.80	2	383	
6.455	15.8	328.9	3.79	2	383	
6.458	15.8	328.4	3.84	3	383	
1876.455		328.77	3.810			

Σ. 2022.

$\alpha = 16^h\ 7^m.9$ $\delta = 26°\ 58'$ (6 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.532	16.2	135.1	2.75	3	606	
9.535	16.7	138.3	2.69	2	606	
1879.533		136.70	2.720			

σ Cor. Bor. = Σ. 2032. *A* and *B*.

$\alpha = 16^h\ 10^m.2$ $\delta = 34°\ 10'$ (5 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.452	15.8	201.1	3.45	2	383	
6.455	16.1	200.0	3.58	3	383	
6.458	15.5	199.0	3.46	3	383	
9.439	15.5	203.6	3.72	3	383	

σ Cor. Bor, = Σ. 2032. *A* and *B*—Continued.

$\alpha = 16^h\ 10^m.2 \qquad \delta = 34°\ 10'$ (5 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.453	15.0	201.3	3.56	3	383	
9.461	15.7	202.3	3.71	2	383	
9.464	15.3	202.8	3.65	2	383	
1876.455		200.03	3.497			
1879.454		202.50	3.660			

A and *C*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.455	16.2	222.7	15.92	2	383	16th mag.
1879.439	15.7	224.4	15.86	3	383	*C* is 16th mag.
1877.947		223.55	15.890			
	$\Delta\rho =$	− 0.01	+ 0.005			
		223.54	15.895			

Antares.

$\alpha = 16^h\ 22^m.1 \qquad \delta = -26°\ 10'$ (1 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.542	16.4	269.5	3.16	2	383	
7.564	16.3	273.2	3.40	2	383	
7.567	16.0	272.6	3.16	2	383	Images blazing.
7.569	16.3	270.8	3.27	2	383	
1877.560		271.52	3.248			

Σ. 2052.

$\alpha = 16^h\ 23^m.6 \qquad \delta = 18°\ 40'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.535	17.0	101.9	2.68	3	606	
9.554	16.7	100.6	2.76	3	606	
9.584	16.9	102.2	2.66	3	383	
1879.558		101.57	2.700			

λ Ophiuchi = Σ. 2055.

$\alpha = 16^h\ 24^m.9 \qquad \delta = 2°\ 15'$ (4 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.452	16.1	36.1	1.45	2	383	
6.455	16.5	33.7	1.49	1.5	383	
6.458	16.4	33.7	1.52	3	383	
6.471	15.3	31.7	. .	2	383	Cloudy.
6.545	16.3	32.1	1.64	3	383	

λ Ophiuchi = Σ. 2055—Continued.

$\alpha = 16^h\ 24^m.9 \quad \delta = 2°\ 15'$ (4 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.535	17.3	35.8	1.34	3	606	
9.554	16.9	34.5	1.61	2	606	Images blurred.
9.584	17.2	34.4	1.50	3	606	
9.587	16.8	35.2	1.40	3	606	
1876.476		33.46	1.525			
1879.567		35.04	1.441			

ζ Herculis = Σ. 2084.

$\alpha = 16^h\ 36^m.8 \quad \delta = 31°\ 49'$ (3 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.458	16.2	144.0	1.29	2	606	Much blurred.
6.559	16.1	142.6	1.33	2	606	
7.583	16.6	133.4	1.19	2	606	
7.591	16.3	134.6	1.29	2	383	
9.453	15.3	122.8	1.48	2	888	
9.464	15.6	120.9	1.54	2	606	
9.467	15.5	119.4	1.44	3	606	
9.469	15.4	119.9	1.53	3	606	
1876.525		143.07	1.317			
1877.587		134.00	1.240			
1879.463		120.75	1.498			

Σ. 2106.

$\alpha = 16^h\ 45^m.4 \quad \delta = 9°\ 36'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.584	17.9	312.9	0.42	3	888	
9.587	17.0	320.7	0.43	3	888	
9.595	17.4	315.5	0.52	2	888	
1879.589		316.37	0.547			

Σ. 2107.

$\alpha = 16^h\ 47^m.1 \quad \delta = 28°\ 52'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.584	18.3	224.4	0.58	2	888	
9.587	17.3	216.6	0.52	3	888	
9.609	16.8	218.6	0.54	2	888	
1879.593		219.87	0.547			

Σ. 2114.

$\alpha = 16^h\ 56^m.2 \quad \delta = 8°\ 37'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.587	17.7	156.0	1.31	3	606	
9.595	17.8	155.8	1.27	2	888	
1879.591		155.90	1.290			

Σ. 2120.

$\alpha = 17^h\ 0^m.0 \quad \delta = 28°\ 16'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.458	16.7	255.9	4.65	4	383	
6.545	16.6	257.2	4.55	3	383	
6.548	16.5	256.7	4.58	3	383	
9.612	17.0	253.3	4.83	3	606	
9.615	17.0	254.4	4.93	3	606	
1876.517		256.60	4.593			
1879.614		253.85	4.880			

μ Draconis = Σ. 2130.

$\alpha = 17^h\ 2^m.8 \quad \delta = 54°\ 38'$ (5 and 5).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.411	15.3	169.6	2.68	2	383	
7.416	15.4	170.9	2.71	2	383	
7.422	14.7	169.1	2.64	3	383	
7.427	15.6	169.4	2.68	2	383	
7.446	15.3	169.2	2.51	3	383	
1877.424		169.64	2.644			

36 Ophiuchi.

$\alpha = 17^h\ 8^m.0 \quad \delta = -26°\ 25'$ (5 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.559	16.8	202.2	4.47	2	383	
6.622	17.5	204.4	4.59	2	383	
6.641	17.2	202.9	4.55	2	383	
7.583	17.1	203.9	4.52	2	383	
7.591	16.6	202.1	4.44	2	383	
1876.999		203.10	4.514			

Σ. 2137.

$\alpha = 17^h\ 10^m.0 \quad \delta = 24°\ 58' \quad$ (3 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.554	17.3	183.1	17.81	2	383	
9.587	17.5	184.3	17.71	3	383	
1879.570		183.70	17.760			
	$\Delta\rho =$	0.00	+ 0.005			
		183.70	17.765			

Σ. 2153.

$\alpha = 17^h\ 14^m.8 \quad \delta = 49°\ 26' \quad$ (8 and 9).

1879.453	15.8	271.0	1.88	2	888	
9.461	16.1	273.0	1.93	2	606	
9.464	16.3	272.0	1.96	2	606	
1879.459		272.00	1.923			

Σ. 2160.

$\alpha = 17^h\ 19^m.1 \quad \delta = 15°\ 43' \quad$ (6 and 10).

1879.554	17.6	68.0	3.88	3	383	
9.587	18.0	67.0	3.87	3	606	
1879.570		67.50	3.875			

Σ. 2161.

$\alpha = 17^h\ 19^m.5 \quad \delta = 37°\ 16' \quad$ (4 and 6).

1879.464	16.6	310.1	3.97	2	383	
9.467	16.1	308.9	3.93	2	383	
9.469	15.7	311.0	3.86	2	383	
1879.467		310.00	3.920			

Σ. 2163.

$\alpha = 17^h\ 19^m.6 \quad \delta = 42°\ 16' \quad$ (10 and 10).

1879.467	16.5	96.5	1.47	3	383	
9.469	16.0	94.6	1.48	3	383	
1879.468		95.55	1.475			

Σ. 2173.

$\alpha = 17^h\ 24^m.2 \qquad \delta = -0°\ 58' \qquad$ (6 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1876.458	17.0	148.3	0.66	3	606	
6.545	16.8	152.6	0.90	2	383	
6.548	16.8	146.9	0.76	2	383	
1876.517		149.27	0.773			

Σ. 2199.

$\alpha = 17^h\ 36^m.4 \qquad \delta = 55°\ 49' \qquad$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.467	16.7	100.6	1.65	3	383	
9.469	14.4	96.6	1.59	2	888	
9.472	14.1	98.4	1.76	3	383	
1879.469		98.53	1.667			

Σ. 2203.

$\alpha = 17^h\ 37^m.6 \qquad \delta = 41°\ 43' \qquad$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.467	17.0	328.6	0.85	2	888	
9.469	16.3	322.9	0.75	3	888	
9.472	14.4	323.0	0.68	2	888	
1879.469		324.83	0.760			

Σ. 2214. *A* and *B*.

$\alpha = 17^h\ 39^m.8 \qquad \delta = 43°\ 47' \qquad$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.467	17.4	212.6	19.58	3	383	
9.469	16.6	213.0	19.51	3	383	
1879.468		212.80	19.545			
	$\Delta\rho =$	0.00	+ 0.006			
		212.80	19.551			

B and *C*. (9 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.467	17.6	146.1	1.36	3	606	
9.469	16.7	143.6	1.35	3	383	
1879.468		144.85	1.355			

Σ. 2215.

$a = 17^h\ 41^m.6 \quad \delta = 17°\ 46'$ (6 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.595	18.4	295.9	0.70	2	888	Clouds.
9.609	17.2	301.6	0.77	2	888	
9.612	17.5	297.2	0.92	2	888	Hazy; images confused.
1879.604		298.44	0.772			

μ^1 Herculis.

$a = 17^h\ 41^m.8 \quad \delta = 27°\ 48'$ (10 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.675	18.8	218.4	1.27	3	606	
5.686	19.0	219.1	1.24	3	383	
5.688	. .	222.2	1.03	3	606	Best distance.
5.691	18.7	220.3	. .	2	383	
5.705	. .	223.1	. .	3	606	
6.548	17.1	225.6	0.77	2	383	
6.559	17.2	224.2	0.68	2	606	
6.622	17.9	223.2	0.72	3	606	
6.628	17.5	220.6	0.71	2	606	
7.583	17.4	233.5	0.84	3	606	
7.591	16.9	232.1	0.86	3	606	
8.503	16.0	233.8	0.88	2	606	
9.543	17.0	237.9	0.98	2	606	
9.546	16.8	238.5	0.93	3	606	
9.549	16.9	242.0	1.00	2	606	Faint.
1875.689		220.62	(1.180)			
1876.589		223.40	0.720			
1877.587		232.80	0.850			
1878.503		233.80	0.880			The distances observed in 1875 are uncertain. It is possible that quadruple distances were measured.
1879.546		239.47	0.970			

μ^2 Herculis. A and $\frac{B+C}{2}$ (4 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.683	18.8	244.1	31.13	2	606	

O. Σ. 338.

$a = 17^h\ 46^m.5 \quad \delta = 15°\ 21'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.587	18.8	204.7	0.71	2	888	
9.595	18.0	19.0	0.68	2	888	
9.609	17.0	21.8	0.74	2	888	
1879.597		21.83	0.710			

A. C. 9.

$\alpha = 17^h\ 49^m.9$ $\delta = 29°\ 50'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.543	17.2	230.5	1.06	2	606	
9.546	17.0	232.2	1.07	3	606	
9.549	17.2	232.6	1.04	3	606	
1879.546		231.77	1.057			

τ Ophiuchi = Σ. 2262.

$\alpha = 17^h\ 56^m.5$ $\delta = -8°\ 11'$ (5 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.628	17.8	250.6	1.71	3	383	
6.641	17.5	250.5	1.71	2	383	
6.644	17.7	252.1	1.73	2	383	
7.534	17.8	250 4	1.51	2	383	Images blurred.
7.542	17.2	249.8	1.55	3	383	
7.564	16.6	249.4	1.60	2	383	
7.569	17.3	246.1	1.46	3	383	
1877.132		249.80	1.618			

Σ. 2267.

$\alpha = 17^h\ 57^m.8$ $\delta = 40°\ 11'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.543	17.5	240.8	1.17	2	606	
9.546	17.3	240.7	1.24	3	606	
9.549	17.4	239.3	1.24	3	606	
1879.546		240.27	1.217			

70 Ophiuchi = Σ. 2272.

$\alpha = 17^h\ 59^m.4$ $\delta = 2°\ 33'$ (5 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.628	18.1	80.5	3.57	3	383	
6.641	17.9	81.0	3.64	2	383	
6.644	18.0	81.3	3.47	3	383	
7.534	17.2	76.0	3.50	2	383	
7.542	17.5	76.1	3.30	3	383	
7.564	16.9	75.9	3.28	2	383	
7.569	17.6	75.3	3.36	3	383	
9.554	17.9	70.0	3.05	2	383	
9.584	18.9	71.9	2.98	2	606	
9.587	18.2	72.0	2.87	3	606	
9.595	13.2	71.0	2.85	3	606	
9.609	17.5	71.7	2.90	2	606	
1876.638		80.93	3.560			
1877.552		75.82	3.360			
1879.588		71.32	2.930			

70 Ophiuchi (a).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1878.840	21.1	49.57	86.80	2	383	
8.842	21.0	49.50	87.24	2	383	
8.845	21.0	49.74	87.39	2	383	
1878.842		49.603	87.143			
	$\Delta\rho$	− 0.012	+ 0.066			
		49.591	87.209			(a) is a small star of about the 13th mag.

70 Ophiuchi (b).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.840	21.1	198.17	71.70	2	383	
8.842	21.0	197.58	71.26	2	383	
8.845	21.0	197.82	71.03	2	383	
1878.842		197.857	71.330			
	$\Delta\rho =$	− 0.012	+ 0.054			
		197.845	71.384			(b) is a small star of about the 13th mag.

72 Ophiuchi = $O. \Sigma.$ 342.

$\alpha = 18^h\ 1^m.6 \quad \delta = 9°\ 33'$ (4 and 7).

Date.	Sid. Time.	Remarks.
1876.723	18.9	No close companion visible; images good through a slight haze.
6.737	18.9	No close companion visible; seeing fair in twilight. A distant comp. in $p=168°$, and $s=51''.2$; mag. 11th, 12th.
9.636	19.3	This star is single; powers, 383 and 606; wt., 3.
9.680	18.1	This star is single; powers, 383 and 606; wt., 2.

Σ. 2281.

$\alpha = 18^h\ 3^m.6 \quad \delta = 3°\ 58'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.584	19.1	242.1	0.96	2	888	Image confused.
9.587	19.0	246.8	0.99	2	888	
1879.586		245.23	0.980			

Σ. 2289.

$\alpha = 18^h\ 4^m.6 \quad \delta = 16°\ 27'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.587	19.2	229.7	1.13	2	888	Faint; clouds.
9.595	18.6	228.5	1.13	2	888	Clouds.
9.683	17.9	234.4	1.18	3	606	
1879.622		230.87	1.147			

Σ. 2315.

$\alpha = 18^h\ 20^m.2 \quad \delta = 27^\circ\ 20'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.615	17.3	238.3	0.31	3	888	
9.636	17.8	241.0	0.30	3	888	
1879.626		239.65	0.305			

Σ. 2323.

$\alpha = 18^h\ 22^m.2 \quad \delta = 58^\circ\ 44'$ (5 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.543	17.7	2.1	3.66	2	606	Very unsteady.
9.546	17.7	359.9	3.62	2	606	
9.549	17.7	0.6	3.63	3	606	
1879.546		0.87	3.637			

O. Σ. 358.

$\alpha = 18^h\ 30^m.5 \quad \delta = 16^\circ\ 54'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.612	17.9	20.9	1.75	3	606	
9.615	17.6	21.9	1.78	3	606	
9.636	18.1	19.9	1.82	3	606	
1879.621		20.90	1.783			

ϵ_1 Lyræ = Σ. 2382.

$\alpha = 18^h\ 40^m.4 \quad \delta = 39^\circ\ 33'$ (5 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.421	16.1	16.3	2.98	2	383	
7.427	16.7	16.7	3.24	2	383	
7.446	16.2	16.2	3.00	2	383	
7.452	15.7	15.1	3.08	2	383	
1877.436		16.07	3.075			

ϵ_2 Lyræ = Σ. 2383.

$\alpha = 18^h\ 40^m.4 \quad \delta = 39^\circ\ 29'$ (5 and 5).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1877.421	16.4	139.7	2.50	2	383	
7.427	16.8	136.9	2.42	2	383	
7.446	16.4	136.4	2.49	2	383	
7.452	15.9	137.2	2.40	2	383	
1877.436		137.55	2.452			

Σ. 2396.

$\alpha = 18^h\ 42^m.9$ $\delta = 10°\ 40'$ (8 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.612	18.3	314.55	21.99	3	606	Hazy.
9.615	17.8	315.38	21.74	3	606	
1879.613		314.96	21.865			
	$\Delta\rho =$	0.00	+ 0.008			
		314.96	21.873			

Anonyma.

$\alpha = 18^h\ 43^m.0$ $\delta = 10°\ 45'$ (10 and 10).

1877.531	17.2	210.0	0.94	2	383	
7.534	17.0	208.1	0.77	2	606	
1877.532		209.05	0.855			

Anonyma.

$\alpha = 18^h\ 43^m.0$ $\delta = 11°\ 20'$ (9 and 10).

1876.680	18.8	224.4	0.96	2	383	9th and 11th mags.
7.536	17.3	231.0	1.07	2	383	9th and 10th mags.
7.542	17.7	229.7	1.09	3	383	
1877.286		228.37	1.040			This star was discovered by S. W. Burnham.

G. A. 5.

$\alpha = 18^h\ 44^m.0$ $\delta = 10°\ 40'$ (10 and 11).

1876.680	18.4	94.2	2.32	3	606	This star was discovered by G. Anderson.

Σ. 2402.

$\alpha = 18^h\ 44^m.1$ $\delta = 10°\ 32'$ (8 and 9).

1876.669	18.6	201.3	0.87	3	606	
6.680	19.2	204.6	0.91	2	606	
9.612	18.5	203.9	1.06	2	888	
9.615	18.1	204.3	1.00	3	606	
1878.144		203.52	0.960			

Σ. 2404.

$\alpha = 18^h\ 45^m.1 \quad \delta = 10°\ 50'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1877.421	16.6	181.7	3.65	3	383	
7.427	17.1	182.2	3.61	2	383	
7.531	16.9	180.7	3.42	2	383	
7.534	16.7	181.7	3.65	2	383	
1877.478		181.57	3.582			

Σ. 2438.

$\alpha = 18^h\ 55^m.5 \quad \delta = 58°\ 4'$ (7 and 8).

1879.546	18.3	This star not double; powers, 383 and 606; thin clouds.

Σ. 2434. *A* and *B*.

$\alpha = 18^h\ 56^m.6 \quad \delta = -0°\ 53'$ (7 and 8).

1879.615	19.0	131.9	23.89	3	606	
9.636	18.4	132.0	23.89	3	606	
1879.625		131.95	23.890			
	$\Delta\rho =$	− 0.01	+ 0.009			
		131.94	23.899			

B and *C*. (8 and 12).

1879.615	19.1	64.3	1.65	3	606	
9.636	18.6	67.6	1.73	2	606	
1879.625		65.95	1.690			

Σ. 2437.

$\alpha = 18^h\ 56^m.6 \quad \delta = 19°\ 0'$ (8 and 8).

1879.612	18.9	67.5	0.78	2	606	Hazy.
9.615	18.7	66.5	0.87	3	606	
1879.613		67.00	0.825			

Σ. 2441.

$\alpha = 18^h\ 57^m.7 \quad \delta \quad 31°\ 16'$ (8 and 9).

1879.549	18.1	280.6	5.50	3	606	
9.609	17.9	283.0	5.48	2	606	
1879.579		281.80	5.490			

ζ Aquilæ.

$\alpha = 18\ 58^{m}.9$ $\delta = 13°\ 41'$ (3 and 15).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1878.714	19.4	61.2	5.61	3	383	
8.717	19.2	60.2	. .	2	383	
8.719	18.9	61.8	5.45	3	383	
9.636	19.0	61.9	(6.24)	3	383	
9.639	18.2	60.4	5.59	3	383	
1879.085		61.10	5.550			

Σ. 2454.

$\alpha = 19^{h}\ 1^{m}.5$ $\delta = 30°\ 15'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.549	18.4	227.4	0.91	3	606	
9.639	18.0	233.3	0.70	3	606	
9.678	18.5	230.4	0.79	2	606	
1879.622		230.37	0.800			

Σ. 2455.

$\alpha = 19^{h}\ 1^{m}.8$ $\delta = 21°\ 59'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.639	17.6	102.5	3.58	3	606	
9.678	18.8	98.6	3.48	2	606	
1879.658		100.55	3.530			

Σ. 2481.

$\alpha = 19^{h}\ 7^{m}.1$ $\delta = 38°\ 36'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.688	18.6	223.1	4.11	2	606	Very unsteady.
9.691	18.7	224.6	4.19	2	606	
1879.690		223.85	4.150			

Σ. 2486.

$\alpha = 19^{h}\ 9^{m}.0$ $\delta = 49°\ 37'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.691	19.0	220.8	9.80	2	606	
9.694	18.7	220.6	9.83	3	383	
1879.692		220.70	9.815			

O. Σ. 368.

$\alpha = 19^h\ 10^m.6 \quad \delta = 15°\ 57'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.639	18.5	214.5	0.80	3	606	
9.678	19.0	212.3	0.78	2	606	
1879.658		213.40	0.790			

Σ. 2496.

$\alpha = 19^h\ 12^m.3 \quad \delta = 49°\ 52'$ (7 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.694	18.9	80.6	2.21	3	383	Comp. 13th mag.
9.708	19.0	76.1	2.51	3	606	
1879.701		78.35	2.360			This star, supposed to be new on September 10, is probably Σ. 2496.

Σ. 2509.

$\alpha = 19^h\ 15^m.6 \quad \delta = 62°\ 59'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.699	19.1	342.3	0.91	3	606	
9.708	19.3	340.0	1.02	2	606	
9.710	18.7	343.7	0.90	2	606	
1879.706		342.00	0.943			

Σ. 2525.

$\alpha = 19^h\ 21^m.7 \quad \delta = 27°\ 8'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.680	18.4	213.8	0.32	3	888	
9.683	18.2	214.3	0.34	3	888	
9.762	19.3	211.4	0.32	3	888	
1879.708		213.17	0.327			

Σ. 2544. *A* and *B*.

$\alpha = 19^h\ 31^m.3 \quad \delta = 8°\ 2'$ (8 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.678	19.5	212.5	0.93	2	606	
9.680	18.8	210.1	0.91	2	606	
1879.679		211.30	0.920			

A and *C*. (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.678	19.6	237.9	15.78	2	606	
9.680	19.0	238.2	15.90	2	606	
1879.679		238.05	15.840			
	$\Delta\rho =$	0.00	+ 0.006			
		238.05	15.846			

Σ. 2553.

$\alpha = 19^h\ 31^m.8 \quad \delta = 61°\ 47'$ (8 and 9).

1879.713	19.0	93.9	0.87	2	888	
9.749	19.2	95.7	0.94	3	606	
1879.731		94.80	0.905			

Σ. 2556.

$\alpha = 19^h\ 34^m.4 \quad \delta = 21°\ 58'$ (7 and 8).

1879.680	19.5	164.3	0.60	2	888	
9.683	18.5	159.2	0.48	2	888	
9.691	19.4	164.9	0.64	2	888	Images blurred.
1879.683		162.38	0.560			

O. Σ. 380.

$\alpha \quad 19^h\ 36^m.9 \quad \delta = 11°\ 33'$ (6 and 7).

1879.639	19.5	77.6	0.54	2	888	
9.680	19.8	78.1	0.59	2	888	
9.683	18.8	74.7	0.54	2	888	
1879.667		76.80	0.557			

Σ. 2576.

$\alpha = 19^h\ 40^m.9 \quad \delta = 33°\ 20'$ (8 and 8).

1879.683	19.1	123.7	3.14	3	606	
9.688	19.1	123.4	3.08	2	606	Clouds.
1879.686		123.55	3.110			

δ Cygni = Σ. 2579.

$\alpha = 19^h\ 41^m.2 \quad \delta = 44°\ 50'$ (3 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1876.723	19.4	339.4	1.21	2	383	Images bad.
6.737	. .	334.3	1.50	2	383	
6.745	18.7	331.3	1.66	2	383	
6.748	18.7	333.6	1.67	2	383	
1876.740		333.97	1.553			

O. Σ. 387.

$\alpha = 19^h\ 44^m.3 \quad \delta = 35°\ 0'$ (7.5 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.748	19.0	115.1	0.50	2	383	
6.759	19.1	110.3	0.50	2	606	Stars of 9th mag.
6.786	19.7	106.9	0.45	3	606	
8.714	18.7	17.4	0.48	3	606	
8.717	18.8	18.6	. .	1	606	Images bad; an error of 90° in this angle in 1876.
8.719	18.7	17.6	0.48	3	606	
9.694	19.1	190.7	0.51	3	888	
9.697	19.2	14.2	0.44	3	888	
1878.197		17.53	0.480			

β Aquilæ = *O.* Σ. 532.

$\alpha = 19^h\ 49^m.4 \quad \delta = 6°\ 6'$ (3 and 12).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.636	19.2	17.0	12.24	3	383	
9.639	19.2	15.4	12.23	2	383	Clouds.
9.678	19.8	16.0	12.38	2	383	
9.680	20.1	16.8	12.40	2	606	
1879.658		16.30	12.312			

Σ. 2607. *A* and *B*.

$\alpha = 19^h\ 53^m.9 \quad \delta = 41°\ 57'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.694	19.6	313.9	0.40	2	888	
9.697	19.6	309.0	0.32	2	888	
1879.695		311.45	0.360			

$\frac{A + B}{2}$ and *C*. (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.694	19.3	293.4	3.17	3	606	
9.697	19.5	293.3	3.27	2	888	
1879.695		293.35	3.220			

Σ. 2658.

$\alpha = 20^h\ 10^m.5 \qquad \delta = 52^\circ\ 45'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.699	19.5	119.4	5.40	2	606	
9.708	19.5	118.9	5.43	2	606	
1879.703		119.15	5.415			

α^2 Capricorni. *B* and *C*.

$\alpha = 20^h\ 11^m.4 \qquad \delta = -12^\circ\ 55'$ (12 and 13).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.719	. .	245.2	1.14	2	383	*s* uncertain.
6.723	19.8	243.1	. .	2	383	Sky became hazy.
8.714	19.0	240.7	1.28	3	383	
8.719	20.0	240.6	0.94	2	383	
9.768	19.7	243.0	1.25	2	606	Faint.
1877.929		242.52	1.152			

O. Σ. 406.

$\alpha = 20^h\ 15^m.9 \qquad \delta = 45^\circ\ 1'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.710	19.5	111.9	0.48	2	888	
9.713	19.2	104.5	0.54	2	888	
9.719	19.5	104.6	0.46	3	888	
9.765	19.6	110.5	0.50	3	888	
1879.727		107.88	0.495			

Σ. 2673.

$\alpha = 20^h\ 17.^m1 \qquad \delta = 12^\circ\ 57'$ (8 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.688	19.6	333.0	2.46	2	383	
9.691	19.8	331.3	2.62	2	606	
1879.690		332.15	2.540			

Σ. 2690 *A* and $\frac{B+C}{2}$.

$\alpha = 20^h\ 25^m.4 \qquad \delta = 10^\circ\ 52'$. (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.732	20.3	255.6	15.40	2	606	
9.735	19.0	255.7	15.46	2	606	
1879.734		255.65	15.430			
	$\Delta\rho =$	0.00	+ 0.004			
		255.65	15.434			

B and *C*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.732	20.5	209.6	0.52	2	888	
9.735	18.8	213.6	0.46	2	888	
1879.734		211.60	0.490			

Σ. 2696.

$a = 20^h\ 27^m.6$ $\delta = 5°\ 1'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.732	20.7	301.1	0.94	2	606	
9.735	19.2	306.7	0.85	2	606	
9.749	20.7	304.4	0.75	3	606	
1879.739		304.07	0.847			

O. Σ. 533.

$a = 20^h\ 33^m.4$ $\delta = 9°\ 40'$ (5 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.694	20.7	326.6	11.45	3	383	
9.697	21.4	324.0	11.37	2	383	Comp. 13th mag.
1879.696		325.30	11.410			
	$\Delta\rho =$	0.00	+ 0.004			
		325.00	11.414			

Σ. 2708. *A* and *B*.

$a = 20^h\ 34^m.1$ $\delta = 38°\ 13'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.786	20.0	334.0	21.71	3	383	
6.817	21.1	333.6	21.79	3	383	
1876.801		333.80	21.750			
	$\Delta\rho =$	0.00	+ 0.006			
		333.80	21.756			

Σ. 2708. *A* and *C*. (7 and 15).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.786	20.2	49.3	14.98	3	383	*C* is 15th mag.
9.765	19.9	46.2	14.96	3	606	*C* is 15th–16th mag.
1878.276		47.75	14.970			
	$\Delta\rho =$	0.00	+ 0.004			
		47.75	14.974			

Σ. 2725.

$\alpha = 20^h\ 40^m.6$ $\delta = 15°\ 28'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.683	20.7	0.9	4.94	2	606	
9.688	20.8	0.9	5.18	2	383	
9.691	20.3	0.1	5.00	2	606	
1879.687		0.63	5.040			

γ Delphini = Σ. 2727.

$\alpha = 20^h\ 41^m.4$ $\delta = 15°\ 41'$ (4 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.735	19.6	270.5	11.30	2	383	
9.741	22.4	272.0	11.23	2	606	
9.749	21.0	271.3	11.50	3	606	
9.765	20.3	271.0	11.37	3	606	
1879.748		271.20	11.350			
	$\Delta\rho =$	0.00	+ 0.003			
		271.20	11.353			

O. Σ. 413.

$\alpha = 20^h\ 42^m.7$ $\delta = 36°\ 3'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1876.786	20.4	83.6	0.71	2	606	
6.825	20.7	85.0	0.78	2	888	
8.714	19.9	82.6	0.50	2	888	Very blazing images.
8.719	19.3	87.3	0.63	2	606	Images blazing.
9.730	20.4	83.4	0.69	3	888	
9.732	20.0	82.8	0.75	2	606	
1878.418		84.18	0.677			

Σ. 2729.

$\alpha = 20^h\ 45^m.1$ $\delta = -6°\ 4'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.754	20.2	155.6	0.38	3	888	
9.760	19.5	155.6	0.43	2	888	
9.762	20.1	156.1	0.40	3	888	
9.768	19.5	156.2	0.39	3	888	
1879.761		155.88	0.400			

O. Σ. 418.

$\alpha = 20^h\ 49^m.9 \quad \delta = 32°\ 15'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.716	18.6	110.5	1.03	3	606	
9.719	19.3	111.8	1.00	3	606	
1879.718		111.15	1.015			

O. Σ. 423.

$\alpha = 20^h\ 50^m.9 \quad \delta = 42°\ 4'$ (7 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.714	20.3	77.5	2.69	3	383	
8.719	19.6	80.0	2.75	3	606	
9.710	20.0	78.8	2.84	2	606	
9.713	19.6	80.7	2.86	2	606	
1879.214		79.25	2.785			

Σ. 2737. *A* and *B*.

$\alpha = 20^h\ 53^m.1 \quad \delta = 3°\ 50'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.694	21.1	284.6	1.06	2	606	
9.710	20.4	285.4	1.04	2	606	
1879.702		285.00	1.050			

Σ. 2737. *A* and *C*. (6 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.694	20.9	73.6	10.68	3	606	
9.710	20.6	74.2	10.63	2	606	
1879.702		73.90	10.655			
	$\Delta\rho$	0.00	+ 0.003			
		73.90	10.658			

Σ. 2741.

$\alpha = 20^h\ 54^m.6 \quad \delta = 49°\ 59'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.699	20.6	30.3	1.95	2	606	
9.708	19.8	32.9	1.90	2	606	
1879.704		31.60	1.925			

Σ. 2744.

$\alpha = 20^h\ 57^m.0 \quad \delta = 1°\ 4'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.694	21.4	172.7	1.47	3	606	
9.708	20.7	172.2	1.54	2	606	
1879.701		172.45	1.505			

Σ. 2746.

$\alpha = 20^h\ 57^m.1 \quad \delta = 38°\ 46'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.710	20.2	293.3	1.05	2	606	
9.713	19.9	289.7	1.04	2	606	
1879.712		291.50	1.045			

Anonyma.

$\alpha = 21^h\ 1^m.0 \quad \delta = 21°\ 8'$ (6 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.921	0.0	64.4	. .	2	606	

61 Cygni.

$\alpha = 21^h\ 1^m.3 \quad \delta = 38°\ 8'$ (6 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.699	21.0	117.4	20.15	2	383	
9.708	20.2	117.2	20.07	2	383	
9.710	19.1	117.9	20.04	3	383	
9.713	20.2	117.9	19.83	3	383	
9.716	19.3	117.9	19.86	2	606	
9.719	19.7	117.8	19.89	3	606	
1879.711		117.68	19.973			
	$\Delta\rho =$	0.00	+0.006			
		117.68	19.979			

Σ. 2760.

$\alpha = 21^h\ 1^m.9 \quad \delta = 33°\ 38'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.713	20.5	225.3	8.61	2	383	
9.716	18.9	224.8	8.57	3	606	
9.719	20.0	225.2	8.48	3	606	
1879.716		225.10	8.553			

Anonyma.

$a = 21^h\ 5.^m7 \quad \delta = -15^\circ\ 31'$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.735	19.8	142.2	3.11	2	383	
9.749	21.3	322.6	3.10	3	606	
1879.742		322.40	3.105			

Σ. 2777.

$a = 21^h\ 8^m.6 \quad \delta = 9^\circ\ 31'$ (4 and 10).

1879.754	With powers 800 A and 1300 I am not certain that this star is double.
9.768	Powers 800 A and 1300; the star seems to be elongated in $p = 150^\circ$, but I am not certain of its duplicity.

τ Cygni.

$a = 21^h\ 10^m.0 \quad \delta = 37^\circ\ 32'$ (5 and 8).

1876.896	21.7	161.9	1.04	2	606	
6.901	22.1	158.5	1.03	2	888	
8.714	21.0	154.4	. .	1	888	
8.807	20.8	163.2	1.09	2	606	
9.730	20.6	153.2	1.03	3	888	
9.749	20.4	147.8	1.00	2	606	
9.751	20.1	146.3	. .	2	888	
9.754	19.6	142.4	0.99	3	888	
9.763	19.6	148.0	0.90	3	888	
9.768	19.3	146.3	0.99	.	. .	
1876.898		160.20	1.035			
1878.760		158.80	1.09			
1879.752		147.33	0.982			This star was discovered by Mr. A. G. CLARK.

τ' Cygni.

1876.901	21.8	260.3	15.68	2	383	15th mag.

Σ. 2799.

$a = 21^h\ 23^m.0 \quad \delta = 10^\circ\ 34'$ (7 and 7).

1878.714	21.2	132.5	1.29	3	383	
8.719	20.5	132.7	1.32	2	383	
1878.716		132.60	1.305			

Σ. 2804.

$a = 21^h\ 27^m.4 \quad \delta = 20°\ 11'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1878.719	20.7	328.6	2.88	3	383	
8.818	21.0	328.8	2.79	3	606	
1878.768		328.70	2.835			

Anonyma.

$a = 21^h\ 32^m.0 \quad \delta = -16°\ 10'$ (8.5 and 13).

1875.902	23.3	125.0	2.17	2	383	
9.754	20.8	123.4	2.10	2	606	
1877.828		124.20	2.135			

μ Cygni = Σ. 2822.

$a = 21^h\ 38^m.7 \quad \delta = 28°\ 13'$ (5 and 6).

1878.845	21.7	118.2	3.79	3	383	
8.848	22.2	119.3	3.68	3	383	
9.754	19.9	119.8	3.65	3	606	
9.760	19.2	120.6	3.65	3	383	
9.762	19.9	119.1	3.74	3	606	
1879.394		119.40	3.702			

Σ. 2847.

$a = 21^h\ 51^m.9 \quad \delta = -4°\ 4'$ (8 and 8).

1879.732	21.3	303.6	1.30	2	606	
9.735	20.1	305.8	1.22	2	606	
1879.734		304.70	1.260			

Σ. 2872. A and $\frac{B + C}{2}$.

$a = 22^h\ 4^m.5 \quad \delta = 58°\ 41'$ (6 and 7).

1879.730	20.9	315.9	21.62	3	606	
9.738	19.7	316.3	21.69	3	606	
1879.734		316.10	21.655			
	$\Delta\rho =$	− 0.01	+ 0.006			
		316.09	21.661			

B and *C*. (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.730	21.1	142.1	0.68	3	888	
9.738	19.9	145.8	0.69	3	606	
1879.734		143.95	0.685			

Σ. 2881.

$\alpha = 22^h\ 9^m.1$ $\delta = 28°\ 57'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.732	21.5	101.7	1.61	2	606	
9.735	20.4	105.0	1.60	2	606	
1879.734		103.35	1.605			

30 Pegasi. *A* and *B*.

$\alpha = 22^h\ 14^m.4$ $\delta = 5°\ 11'$ (6 and 12).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.721	. .	21.0	6.23	3	383	
5.803	. .	17.6	6.38	3	383	
5.823	. .	18.5	. .	.	383	
9.732	22.0	18.6	6.36	2	606	
1876.770		18.92	6.323			

A and *C*. (6 and 12).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.721	. .	221.2	9.70	3	383	
5.803	. .	221.8	9.91	3	383	
5.823	. .	219.0	. .	2	383	
9.732	21.8	222.4	10.21	2	606	
1876.770		221.10	9.940			

Σ. 2895.

$\alpha = 22^h\ 15^m.1$ $\delta = 24°\ 20'$ (8 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.732	22.3	29.2	6.85	2	606	
9.735	20.7	28.6	6.82	2	606	
1879.734		28.90	6.835			

34 Pegasi.

$\alpha = 22^h\ 20^m.5 \quad \delta = 3°\ 47'$ (6 and 13).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1875.719	. .	225.9	2.56	3	383	
5.828	. .	220.7	2.66	2	606	
1875.774		223.30	2.610			

ζ Aquarii = Σ. 2909.

$\alpha = 22^h\ 22^m.6 \quad \delta = -0°\ 38'$ (4 and 5).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1875.908	. .	337.4	4.11	1	383	Diffuse images.
5.921	0.5	331.8	3.61	3	606	
5.970	0.5	333.9	3.91	3	383	
5.976	1.0	332.1	3.84	3	383	
8.870	22.2	156.3	3.49	3	383	
8.873	22.3	335.2	3.39	2	383	
8.875	22.0	334.9	3.45	3	383	
9.735	21.0	332.6	3.59	2	383	
9.738	22.1	332.6	3.46	2	383	
9.741	22.1	333.4	3.26	3	606	
9.749	21.6	333.4	3.31	3	606	
1878.123		333.96	3.565			

Σ. 2920. *A* and *B*.

$\alpha = 22^h\ 28^m.2 \quad \delta = 3°\ 32'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.870	22.5	143.4	13.71	3	383	
8.873	22.5	143.3	13.60	3	383	
1878.872		143.35	13.655			
	$\Delta\rho =$	0.00	+ 0.005			
		143.35	13.660			

A and *C*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.873	22.7	62.5	22.20	3	383	*C* is 14th mag.

Lalandė 44276.

$\alpha = 22^h\ 33^m.2 \quad \delta = -13°\ 14'$ (9 and 9.2).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.754	22.1	137.0	4.42	3	606	
9.768	22.0	316.3	4.36	3	606	
1879.761		316.65	4.390			

O. Σ. 477.

$\alpha = 22^h\ 38^m.3 \quad \delta = 45°\ 21'$ (7 and 11).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1879.738	21.3	152.7	5.03	3	606	
9.752	19.8	153.3	4.99	2	383	
1879.745		153.00	5.010			

Bradley 3011.

$\alpha = 22^h\ 41^m.6 \quad \delta = -4°\ 51'$ (8 and 8).

1879.754	21.3	252.8	3.54	3	606	
9.768	21.8	253.6	3.71	3	606	
1879.761		253.20	3.625			

O. Σ. 536.

$\alpha = 22^h\ 52^m.6 \quad \delta = 8°\ 44'$ (8 and 8).

1879.754	22.4	167.2	0.36	3	888	
9.768	22.5	166.5	0.35	3	888	
9.776	22.9	168.3	0.37	3	888	
1879.766		167.33	0.360			

O. Σ. 483.

$c = 22^h\ 53^m.2 \quad \delta = 11°\ 5'$ (6 and 8).

1878.818	21.3	208.3	0.98	3	606	
9.754	22.6	206.1	1.08	3	888	
9.768	22.3	206.4	1.11	3	606	
9.776	22.7	205.7	1.05	3	606	
1879.529		206.62	1.055			

Σ. 2978.

$\alpha = 23^h\ 1^m.7 \quad \delta = 32°\ 11'$ (7 and 8).

1878.870	23.0	143.8	8.52	3	383	
8.873	22.8	144.7	8.54	2	383	
1878.871		144.25	8.530			

Σ. 2989.

$\alpha = 23^h\ 7^m.2$ $\delta = 19^\circ\ 20'$ (9 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1878.818	21.6	142.0	1.64	3	606	
8.826	21.5	141.8	1.64	2	606	
1878.822		141.90	1.640			

Σ. 3001.

$\alpha = 23^h\ 13^m.7$ $\delta = 67^\circ\ 27'$ (6 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.820	21.9	193.4	2.52	2	383	
9.828	22.7	191.9	2.85	3	383	
9.831	22.9	193.1	2.77	3	383	
9.834	21.3	195.5	2.76	3	606	
1879.828		193.48	2.725			

Σ. 3006.

$\alpha = 23^h\ 15^m.4$ $\delta = 34^\circ\ 47'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.768	23.0	171.1	5.25	3	606	
9.776	23.2	170.5	5.32	3	606	
1879.772		170.80	5.285			

Σ. 3008.

$\alpha = 23^h\ 17^m.5$ $\delta = -9^\circ\ 7'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.751	23.0	254.3	4.95	2	383	
9.754	23.8	255.6	4.92	3	606	
9.768	23.3	254.3	4.93	3	606	
1879.758		254.73	4.933			

O. Σ. 500.

$\alpha = 23^h\ 31^m.7$ $\delta = 43^\circ\ 46'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.793	23.3	313.4	0.53	2	888	
9.803	23.0	317.2	0.48	3	888	
9.817	22.6	318.8	0.54	3	606	
1879.804		316.47	0.517			

O. Σ. 513.

$\alpha = 23^h\ 52^m.2 \quad \delta = 34°\ 22' \quad$ (7 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1878.856	23.5	21.9	3.62	3	383	
8.859	21.9	25.8	3.55	3	383	
8.867	22.7	22.5	3.63	3	383	
1878.861		23.40	3.600			

Anonyma.

$\alpha = 23^h\ 58^m.5 \quad \delta = 45°\ 0' \quad$ (9 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.793	23.6	338.8	4.35	2	606	
9.817	22.9	341.6	4.15	2	383	
1879.805		340.20	4.250			This star was observed for O. Σ. 547.

O. Σ. 547.

$\alpha = 23^h\ 59^m.2 \quad \delta = 45°\ 9' \quad$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1879.803	23.3	293.9	4.33	3	606	
9.817	23.1	294.0	4.38	3	383	
1879.810		293.95	4.355			

Σ. 3060.

$\alpha = 23^h\ 59^m.5 \quad \delta = 17°\ 25' \quad$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.845	22.1	117.8	3.56	3	383	
8.848	22.7	116.9	3.68	3	383	
8.867	23.1	117.9	3.77	2	383	
1878.853		117.53	3.670			

Σ. 3061.

$\alpha = 23^h\ 59^m.5 \quad \delta = 17°\ 10' \quad$ (8 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1878.818	21.9	147.6	7.75	3	606	
8.826	21.8	147.4	7.72	2	606	
1878.822		147.50	7.735			

Σ. 3062.

$\alpha = 23^h\ 59^m.9$ $\delta = 57°\ 46'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1879.062	2.8	301.5	1.57	3	606	
9.064	2.3	301.2	1.46	2	383	
9.081	3.6	300.2	1.38	3	383	
9.084	2.7	301.6	1.40	3	383	
9.820	22.3	302.6	1.56	2	383	
9.828	22.9	302.8	1.61	3	606	
9.831	23.1	302.9	1.51	2	606	
9.834	21.5	302.2	1.48	3	606	
1879.450		301.88	1.496			

§ 8.

THE COMPANION OF SIRIUS.

The companion of Sirius was discovered by Mr. ALVAN G. CLARK at Cambridge, January 31, 1862, with the 18½-inch objective, made by ALVAN CLARK & SONS for the University of Mississippi, and afterward mounted at Chicago. This interesting discovery appeared to confirm the theory which BESSEL had drawn from the variable proper motion of Sirius, and the attention of astronomers was naturally turned to this companion, which has been frequently observed. The earliest observations are those made by Professor G. P. BOND with the 15-inch refractor of the Harvard College Observatory. I assisted Professor BOND in those observations, and saw the companion on several nights. Generally it was a difficult object in the Harvard College telescope, since the images of the stars were often very unsteady, and the companion was partially hidden in the rays of the bright star. On joining the Naval Observatory in the summer of 1862, I found that Mr. FERGUSON and Captain GILLISS, the Superintendent, had looked for this companion with the 9.6-inch Equatorial on many nights, but without success. Several trials were again made by Mr. FERGUSON and myself in 1863 and in 1864, but these being unsuccessful, the object was given up as being too difficult for the Washington telescope. On making a trial, however, in the twilight on March 13, 1866, I saw the companion without the least difficulty, it being as easily seen as the companion of Rigel. I observed the companion of Sirius with the 9.6-inch Equatorial in the years 1866, 1872, and 1873. These observations were made with difficulty, the driving-clock of this instrument not performing well; and the observations are not so good as those made with the 26-inch refractor, but for the sake of completeness they are given below. The angle observed in 1873 has probably an error of $+5°$.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1866.199	7.4	76.4	9.54	.	280	The night very fair; p good, s doubtful.
6.238	7.0	. .	10.67	.	280	The night bad.
6.257	. .	71.7	10.32	.	280	The night very good.
1872.149	. .	65.9	. .	2	202	
2.239	. .	62.9	10.82	2	202	
2.242	. .	64.3	. .	3	202	
2.245	. .	64.5	11.71	4	279	
2.256	. .	64.6	11.60	3	279	
2.264	. .	64.1	11.28	2	279	
2.280	. .	63.5	11.90	2	279	
1873.203	. .	65.8	11.12	2	279	Two comparisons.
1874.232	7.7	57.6	11.04	2	412	This observation and the following were made with the 26-inch refractor.
4.235	7.7	58.5	11.17	3	412	
1875.265	8.0	56.6	10.99	3	606	
5.270	8.1	56.2	11.36	3	606	
5.287	. .	56.1	11.01	2	392	
5.306	. .	56.6	10.95	2	392	
1876.174	6.8	55.3	11.26	2	383	
6.187	6.6	56.0	11.18	2	383	
6.190	6.7	55.2	11.42	2	383	
6.228	8.1	55.4	11.07	3	383	
6.267	7.9	54.9	11.07	3	383	
6.272	8.3	54.5	11.16	2	383	
1877.228	6.7	53.8	10.99	2	606	
7.258	7.5	53.3	10.87	2	606	Images blazing.
7.263	7.9	53.3	10.96	2	606	
7.266	8.0	53.1	10.93	2	606	Faint through thin clouds.
7.269	8.0	53.4	10.99	3	606	
1878.232	6.9	52.3	10.91	2	606	
8.235	7.3	51.6	10.81	3	606	
8.243	7.0	51.1	10.61	2	606	Images very unsteady.
8.254	7.5	51.3	10.79	2	606 p 383 s	Very unsteady.
8.263	7.5	52.2	10.70	3	606	
1879.191	6.9	50.0	10.33	2	383	Images unsteady.
9.193	7.2	50.4	10.74	2	383	
9.196	5.8	49.9	10.53	4	383	
9.199	6.0	50.7	10.46	2	383	Comp. faint.
9.212	6.3	50.4	10.67	3	383	
9.215	6.7	49.4	10.57	2	383	Images unsteady.

The following are the mean results of these observations:

Date.	p	s	Number of observations.		Date.	p	s	Number of observations.	
	°	"				°	"		
1866.231	74.05	10.212	2.	3.	1876.220	55.22	11.193	6.	6.
1872.239	64.26	11.462	7.	5.	1877.257	53.38	10.948	5.	5.
1873.203	65.8	11.12	1.	1.	1878.245	51.70	10.764	5.	5.
1874.233	58.05	11.105	2.	2.	1879.201	50.13	10.550	6.	6.
1875.282	56.38	11.078	4.	4.					

In the case of these observations each single observation made with the 26-inch refractor depends on five settings of the position circle, and on five measurements of the double distance. From the 28 observations I find the following values of the probable errors of a single observation:

Probable error of a single angle of position $= \pm 0^\circ.272$
" at $s = 11''.00$, $= \pm 0''.052$
" of a single distance, $= \pm 0''.079$

In deriving the mean results all the observations have been given the same weight except the first two distances observed in 1866, which have been given a weight of one-half.

§ 9.

THE RING NEBULA IN LYRA.

$\alpha = 18^h\ 49^m.1 \qquad \delta = 32^\circ\ 52'$

In the following observations of the faint stars near this nebula the stars are designated by the letters *a*, *b*, *c*, etc., *a* being the brightest of these stars, and the one near the following end of the nebula. The angles and distances are referred to *a*, except in the case of the companion of the triple star *f*, where these quantities are referred to *f* itself. My estimated magnitudes of these stars are probably too bright, but they are given as they were made. Each measure is the result of two settings of the position circle for the angle, and of two measures of the double distance.

a and *b*. (10 and 14).

Date.	Sid. Time.	*p*	*s*	Wt.	Power.	Remarks.
	h.	°	″			
1877.580	18.0	225.6	93.93	2	383	
7.583	. .	225.4	93.87	3	383	
1877.582		225.50	93.90			
			a and *c*. (10 and 13.14).			
1877.580	18.2	268.2	115.85	2	383	
7.583	. .	267.8	115.82	3	383	
1877.582		268.00	115.84	.		
			a and *d*. (10 and 12.13).			
1877.591	17.3	287.0	138.68	3	383	
7.594	16.5	286.8	138.49	2	383	
1877.592		286.90	138.58			

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
			a and *e*. (10 and 12).			
	h.	°	″			
1877.591	17.5	292.6	123.15	3	383	
7.594	16.7	292.6	122.66	2	383	
1877.592		292.60	122.90			
			a and *f*. (10 and 13.14).			
1877.580	17.8	313.7	101.43	2	383	
7.583	. .	313.7	102.16	3	383	
1877.582		313.70	101.79			
			a and *g*. (10 and 13).			
1877.591	17.6	351.1	77.18	3	383	
7.594	. .	350.1	77.18	2	383	
1877.592		350.60	77.18			
			f and f_1. (13.14 and 13.14).			
1877.591	. .	255.1	3.73	3	383	
7.594	. .	251.5	4.19	2	383	
1877.592		253.30	3.96			
			f and f_2. (13.14 and 14.15).			
1877.591	. .	5.9	17.81	3	383	
7.594	. .	3.7	16.82	2	383	
1877.592		4.80	17.32			

The following estimates were made to connect the nebula with the stars:

(α) The right line a to b is 11″ outside of the nebula.
(β) The right line a to c very nearly bisects the darker, interior part of the nebula.
(γ) The right line a to f is very nearly tangent to the nebula.
(δ) The right line b to c is nearly tangent to the nebula.

During these observations no star was seen inside the above ring of stars, nor any star within the nebula itself. Afterwards it was thought that a star was seen within the nebula, but I could not measure it.

OBSERVATIONS MADE WITH THE 9.6-INCH EQUATORIAL.

While making his observations at Santiago, Chili, Captain GILLISS observed the differences of right ascension and declination of a number of double stars, and from these observed differences he had his computers determine the angles of position and the distances of the stars. Being desirous of comparing the accuracy of such angles

and distances with that of those found by observing with a filar micrometer, Captain Gilliss directed me in 1863 to observe certain double stars with our 9.6-inch refractor. These observations were made under unfavorable circumstances, the driving-clock of this instrument being very troublesome, but a comparison showed that the positions found with the filar micrometer were decidedly better than those deduced from the observed differences of right ascension and declination.

The following are the stars observed by me in 1863. These observations were made soon after the object-glass had been refigured by Alvan Clark & Sons, and before the value of a revolution of the screw of the micrometer had been well determined. I have, therefore, revised my former reductions, and have computed the distances with the value of a revolution.

$$R = 15''.3014$$

The approximate values of the right ascensions and declinations are given for 1880.0.

11 Monocerotis = Σ. 919. *A* and *B*.

$\alpha = 6^h\ 22^m.$) $\delta = -6°\ 56'$ (5 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1863.205	. .	130.1	7.47	3	280	

A and *C*.

1863.205	. .	123.0	9.81	3	280	Clouds; only one measure of distance.

B and *C*.

1863.205	. .	106.8	. .	3	280	Clouds.

2 Navis = Σ. 1138.

$\alpha = 7^h\ 39^m.9$ $\delta = -14°\ 24'$ (6 and 7).

1863.243	8.2	338.6	16.70	2	280	

5 Navis = Σ. 1146.

$\alpha = 7^h\ 42^m.3$ $\delta = -11°\ 54'$ (5 and 7).

1863.197	8.5	15.8	3.82	3	280	

φ^2 Cancri = Σ. 1223.

$\alpha = 8^h\ 19^m.6$ $\delta = 27°\ 20'$ (6 and 6.5).

1863.268	11.4	214.5	4.97	3	280	

ν^1 Cancri = Σ. 1224.

$a = 8^h\ 19^m.7 \quad \delta = 24°\ 55'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1863.268	10.3	39.8	5.98	4	280	

P. 108 = Σ. 1245.

$a = 8^h\ 29^m.4 \quad \delta = 7°\ 3'$ (6 and 8).

1863.172	. .	25.8	10.40	3	280	
3.197	. .	25.8	10.49	3	280	
1863.184		25.80	10.44			

P. 160 = Σ. 1270.

$a = 8^h\ 39^m.3 \quad \delta = -2°\ 9'$ (6.6 and 7.6).

1863.243	9.7	260.1	4.88	3	280	

Σ. 66.

$a = 10^h\ 37^m.1 \quad \delta = 5°\ 23'$ (6 and 7).

1863.236	10.3	240.6	6.42	3	280	
3.301	10.8	239.1	6.94	2	280	
1863.268		239.85	6.68			

Σ. 1482.

$a = 10^h\ 45^m.9 \quad \delta = 8°\ 7'$ (8 and 9).

1863.292	11.4	304.9	11.32	3	280	

54 Leonis = Σ. 1487.

$a = 10^h\ 49^m.1 \quad \delta = 25°\ 24'$ (5 and 7).

1863.292	12.6	102.2	6.33	3	280	

Σ. 1540.

$a = 11^h\ 20^m.7 \quad \delta = 3°\ 40'$ (6 and 7).

1863.301	12.5	149.7	30.12	2	280	

Σ. 1604. *A* and *B*.

$\alpha = 12^{h}\ 3^{m}.3 \qquad \delta = -11° 11'$ (6.5 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1863.312	12.8	94.6	11.38	3	280	

A and *C*.

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.312	12.8	94.6	48.51	3	280	

Σ. 1636.

$\alpha = 12^{h}\ 16^{m}.4 \qquad \delta \quad 5° 58'$ (6 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.312	13.2	335.4	19.96	3	280	

5 Serpentis = Σ. 1930.

$\alpha = 15^{h}\ 13^{m} \qquad \delta = 2° 14'$ (5 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.607	17.3	40.6	10.59	3	280	

51 Libræ.

$\alpha = 15^{h}\ 57^{m}.7 \qquad \delta = -11° 2'$ (6 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.499	. .	70.6	7.02	2	280	
3.542	. .	68.9	7.49	3	280	
1863.520		69.75	7.255			

Σ. 1999.

$\alpha = 15^{h}\ 57^{m}.7 \qquad \delta = -11° 7'$ (7.5 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.499	. .	100.6	10.72	2	280	

β Scorpii.

$\alpha = 15^{h}\ 58^{m}.5 \qquad \delta = -19° 29'$ (2 and 4).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.599	18.3	24.5	13.97	3	280	

α Herculis = Σ 2140.

$\alpha = 17^{h}\ 9^{m}.2 \qquad \delta = 14° 32'$ (3 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.580	19.7	116.5	4.26	3	280	

Σ. 2149.

$\alpha = 17^h\ 13^m.6$ $\delta = -6^\circ\ 16'$ (9 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1863.608	18.4	23.9	7.82	3	280	

ν Serpentis.

$\alpha = 17^h\ 14^m$ $\delta = -12^\circ\ 43'$ (6 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.608	17.8	31.6	48.09	3	280	

Σ. 2204.

$\alpha = 17^h\ 39^m.7$ $\delta = -13^\circ\ 14'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.608	19.0	24.7	14.90	3	280	

Σ. 2234.

$\alpha = 17^h\ 46^m.4$ $\delta = -7^\circ\ 56'$ (8.6 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.619	18.6	198.9	17.41	2	280	

Σ. 2244.

$\alpha = 17^h\ 50^m.8$ $\delta = 0^\circ\ 7'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.633	18.3	276.1	0.85	3	400	

Σ. 2245.

$\alpha = 17^h\ 51^m.2$ $\delta = 18^\circ\ 21'$ (7 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.619	20.1	295.7	2.98	3	400	

70 Ophiuchi = Σ. 2272.

$\alpha = 17^h\ 59^m.3$ $\delta = 2^\circ\ 33'$ (4 and 6).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.608	20.2	106.9	5.75	3	280	
3.619	19.2	106.1	6.05	3	280	
3.633	17.6	104.9	5.88	3	400	
3.671	18.1	105.0	5.65	3	400	
3.677	19.0	104.8	5.73	3	400	
1863.642		105.54	5.81			

73 Ophiuchi = Σ. 2281.

$\alpha = 18^h\ 3^m.4$ $\delta = 3°\ 58'$ (6 and 7).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	″			
1863.633	18.6	257.7	1.38	4	400	

Σ. 2287.

$\alpha = 18^h\ 4^m.4$ $\delta = 2°\ 35'$ (10 and 10).

1863.633	19.1	150.8	22.22	3	280	

Σ. 2288.

$\alpha = 18^h\ 4^m.4$ $\delta = 2°\ 31'$ (9 and 11).

1863.633	19.7	63.0	16.18	3	280	

59 Serpentis = Σ. 2316.

$\alpha = 18^h\ 21^m.1$ $\delta = 0°\ 6'$ (6 and 8).

1863.633	20.1	312.7	4.09	3	400	

Σ. 2391.

$\alpha = 18^h\ 42^m.4$ $\delta = -6°\ 8'$ (7 and 10).

1863.633	20.5	331.5	38.87	3	280	

θ Serpentis = Σ. 2417.

$\alpha = 18^h\ 50^m.4$ $\delta = 4°\ 1'$ (4 and 4).

1863.633	20.9	104.5	22.19	3	400	
3.671	18.9	102.9	21.76	3	400	
1863.652		103.70	21.975			

Σ. 2447.

$\alpha = 19^h\ 0^m.2$ $\delta = -1°\ 31'$ (7 and 9).

1863.651	20.7	342.1	14.35	2	400	

Σ. 2601.

$\alpha = 19^h\ 50^m.7 \quad \delta = 1°\ 36'$ (8 and 10).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
	h.	°	"			
1863.676	19.6	163.9	7.65	3	280	

Σ. 2612.

$\alpha = 19^h\ 55^m\ 6 \quad \delta = 6°\ 36'$ (8 and 9).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.676	20.4	53.1	38.18	3	280	

Σ. 2613.

$\alpha = 19^h\ 55^m.7 \quad \delta = 10°\ 24'$ (7 and 8).

Date.	Sid. Time.	p	s	Wt.	Power.	Remarks.
1863.676	21.4	347.5	4.29	2	400	

§ 10.

TABLES FOR COMPUTING REFRACTION.

If φ be the latitude of the place of observation, and we denote by δ and t the declination and hour angle of a star, by z its zenith distance, and by q the parallactic angle, we have from the spherical triangle between the pole, the zenith, and the star:

$$\begin{aligned}
\cos z &= \sin\varphi \sin\delta + \cos\varphi \cos\delta \cos t \\
\sin z \cos q &= \sin\varphi \cos\delta - \cos\varphi \sin\delta \cos t \\
\sin z \sin q &= \cos\varphi \sin t
\end{aligned}$$

If we put

$$\begin{aligned}
\sin n &= \cos\varphi \sin t \\
\cos n \sin N &= \cos\varphi \cos t \\
\cos n \cos N &= \sin\varphi
\end{aligned}$$

we shall have for computing z and q;

$$\begin{aligned}
\tang z \sin q &= \tang n.\ \operatorname{cosec}(N+\delta) \\
\tang z \cos q &= \operatorname{cotang}(N+\delta).
\end{aligned}$$

Generally we may use for equatorial observations the simple formula for refraction,

$$\Delta z = k.\ \tang z:$$

where $k = 57''.65$. The corrections for the observed hour angle and declination are

$$\Delta t = +\frac{k.\cos\varphi\sin t}{\cos n\cos\delta\sin(N+\delta)} = +\frac{k.\ \tang t\sin N}{\cos\delta\sin(N+\delta)}:$$

$$\Delta\delta = -k.\ \operatorname{cotang}(N+\delta).$$

For computing the differential refraction for the distance and the angle of position, we have the following formulæ given by BESSEL, *Astronomische Untersuchungen*, Bd. I, p. 165.

$$\sigma = s'' + s''. \frac{k}{206265} \left\{ \text{tang } z^2 \cos (p - q)^2 + 1 \right\},$$

$$\pi = p^\circ - \frac{k}{3600} \left\{ \text{tang } z^2 \cos (p - q) \sin (p - q) + \text{tang } z \sin q \text{ tang } \delta \right\}.$$

In these formulæ s and p are the observed values of the distance and angle of position, and σ and π are the corrected values. The other symbols have the meanings given above.

The following table gives for the latitude of the Naval Observatory $\varphi = + 38^\circ 53'.65$, the values of N, log *cos n*, and log *tang n*, for each minute of the hour angle. The first hour of this table was computed directly, and for the rest an attempt was made to use a manuscript table computed many years ago at the Observatory, but it was found so full of small errors that this part of the table has been computed anew by Professor FRISBY. We may take *cos n* positive, and N will have the same sign as the *cosine* of the hour angle, and *tang n* that of the *sine*.

The table for the factor k is from BESSEL'S *Astronomische Untersuchungen*, Bd. I, p. 198. This factor is of this form:

$$k = \alpha \, \beta^A \, \gamma^\lambda.$$

but generally in differential work we may take $k = \alpha$. This factor is expressed in seconds of arc.

t	*N*	cos *n*	tan *n*	*t*	*t*	*N*	cos *n*	tan *n*	*t*
h. m.	° ′			h. m.	h. m.	° ′			h. m.
0 0	51 6.3	0.00000	∞ neg.	12 0	0 46	50 32.2	9.99471	9.19610	11 14
0 1	6.3	0.00000	7.53097	11 59	0 47	30.7	9.99448	9.20554	11 13
0 2	6.3	9.99999	7.83200	11 58	0 48	29.1	9.99424	9.21479	11 12
0 3	6.2	9.99998	8.00910	11 57	0 49	27.6	9.99400	9.22386	11 11
0 4	6.1	9.99996	8.13304	11 56	0 50	26.0	9.99375	9.23274	11 10
0 5	6.0	9.99994	8.22996	11 55	0 51	24.3	9.99350	9.24145	11 9
0 6	5.8	9.99991	8.30916	11 54	0 52	22.6	9.99324	9.25000	11 8
0 7	5.6	9.99987	8.37613	11 53	0 53	20.9	9.99297	9.25839	11 7
0 8	5.3	9.99984	8.43413	11 52	0 54	19.1	9.99271	9.26662	11 6
0 9	5.0	9.99980	8.48530	11 51	0 55	17.3	9.99244	9.27471	11 5
0 10	4.7	9.99975	8.53108	11 50	0 56	15.5	9.99216	9.28266	11 4
0 11	4.4	9.99970	8.57250	11 49	0 57	13.7	9.99188	9.29048	11 3
0 12	4.0	9.99964	8.61031	11 48	0 58	11.8	9.99159	9.29816	11 2
0 13	3.6	9.99958	8.64500	11 47	0 59	9.9	9.99130	9.30571	11 1
0 14	3.2	9.99951	8.67732	11 46	1 0	7.9	9.99100	9.31314	11 0
0 15	2.8	9.99944	8.70731	11 45	1 1	5.9	9.99070	9.32045	10 59
0 16	2.3	9.99936	8.73538	11 44	1 2	3.9	9.99040	9.32765	10 58
0 17	1.7	9.99927	8.76174	11 43	1 3	50 1.8	9.99009	9.33474	10 57
0 18	1.2	9.99918	8.78660	11 42	1 4	49 59.7	9.98977	9.34172	10 56
0 19	51 0.6	9.99909	8.81013	11 41	1 5	57.6	9.99945	9.34859	10 55
0 20	50 59.9	9.99900	8.83245	11 40	1 6	55.4	9.98912	9.35537	10 54
0 21	59.3	9.99890	8.85368	11 39	1 7	53.2	9.98879	9.36205	10 53
0 22	58.6	9.99879	8.87394	11 38	1 8	51.0	9.98846	9.36863	10 52
0 23	57.9	9.99868	8.89329	11 37	1 9	48.7	9.98812	9.37512	10 51
0 24	57.1	9.99857	8.91183	11 36	1 10	46.4	9.98777	9.38152	10 50
0 25	56.3	9.99844	8.92961	11 35	1 11	44.0	9.98742	9.38784	10 49
0 26	55.5	9.99831	8.94670	11 34	1 12	41.6	9.98706	9.39407	10 48
0 27	54.6	9.99818	8.96315	11 33	1 13	39.2	9.98670	9.40022	10 47
0 28	53.8	9.99804	8.97901	11 32	1 14	36.8	9.98634	9.40629	10 46
0 29	52.9	9.99789	8.99432	11 31	1 15	34.3	9.98597	9.41228	10 45
0 30	51.9	9.99775	9.00910	11 30	1 16	31.7	9.98559	9.41820	10 44
0 31	50.9	9.99760	9.02341	11 29	1 17	29.2	9.98521	9.42404	10 43
0 32	49.9	9.99744	9.03727	11 28	1 18	26.6	9.98483	9.42981	10 42
0 33	48.8	9.99727	9.05071	11 27	1 19	23.9	9.98444	9.43552	10 41
0 34	47.7	9.99711	9.06374	11 26	1 20	21.2	9.98404	9.44116	10 40
0 35	46.6	9.99694	9.07641	11 25	1 21	18.5	9.98364	9.44673	10 39
0 36	45.5	9.99676	9.08872	11 24	1 22	15.8	9.98324	9.45224	10 38
0 37	44.3	9.99658	9.10071	11 23	1 23	13.0	9.98283	9.45768	10 37
0 38	43.1	9.99639	9.11236	11 22	1 24	10.1	9.98241	9.46306	10 36
0 39	41.9	9.99619	9.12374	11 21	1 25	7.2	9.98199	9.46838	10 35
0 40	40.6	9.99599	9.13482	11 20	1 26	4.3	9.98157	9.47365	10 34
0 41	39.3	9.99579	9.14564	11 19	1 27	49 1.4	9.98114	9.47886	10 33
0 42	37.9	9.99559	9.15620	11 18	1 28	48 58.4	9.98071	9.48402	10 32
0 43	36.5	9.99537	9.16652	11 17	1 29	55.4	9.98027	9.48912	10 31
0 44	35.1	9.99516	9.17659	11 16	1 30	52.4	9.97983	9.49416	10 30
0 45	33.7	9.99494	9.18645	11 15	1 31	49.3	9.97938	9.49916	10 29
0 46	50 32.2	9.99471	9.19610	11 14	1 32	48 46.1	9.97893	9.50410	10 28

For hour angles between 12^h and 24^h, add 12^h to the preceding argument. *N* has the sign of the cosine of the hour angle; tan *n* that of the sine.

t	*N*	cos *n*	tan *n*	*t*	*t*	*N*	cos *n*	tan *n*	*t*
h. m.	° ′			h. m.	h. m.	° ′			h. m.
1 32	48 46.1	9.97893	9.50410	10 28	2 18	45 36.7	9.95308	9.69120	9 42
1 33	42.9	9.97847	9.50899	10 27	2 19	31.5	9.95241	9.69461	9 41
1 34	39.7	9.97801	9.51384	10 26	2 20	26.3	9.95174	9.69800	9 40
1 35	36.5	9.97754	9.51864	10 25	2 21	21.0	9.95106	9.70137	9 39
1 36	33.2	9.97707	9.52340	10 24	2 22	15.7	9.95038	9.70472	9 38
1 37	29.9	9.97659	9.52811	10 23	2 23	10.3	9.94970	9.70805	9 37
1 38	26.5	9.97611	9.53277	10 22	2 24	45 4.9	9.94901	9.71136	9 36
1 39	23.1	9.97562	9.53739	10 21	2 25	44 59.4	9.94832	9.71465	9 35
1 40	19.6	9.97513	9.54197	10 20	2 26	53.9	9.94762	9.71792	9 34
1 41	16.1	9.97464	9.54651	10 19	2 27	48.3	9.94692	9.72117	9 33
1 42	12.6	9.97414	9.55100	10 18	2 28	42.7	9.94622	9.72440	9 32
1 43	9.0	9.97364	9.55545	10 17	2 29	37.0	9.94551	9.72761	9 31
1 44	5.4	9.97313	9.55987	10 16	2 30	31.3	9.94479	9.73080	9 30
1 45	48 1.7	9.97261	9.56425	10 15	2 31	25.5	9.94408	9.73398	9 29
1 46	47 58.0	9.97209	9.56859	10 14	2 32	19.7	9.94336	9.73714	9 28
1 47	54.3	9.97157	9.57289	10 13	2 33	13.8	9.94263	9.74028	9 27
1 48	50.5	9.97104	9.57716	10 12	2 34	7.8	9.94190	9.74340	9 26
1 49	46.7	9.97051	9.58139	10 11	2 35	44 1.8	9.94117	9.74650	9 25
1 50	42.8	9.96997	9.58558	10 10	2 36	43 45.8	9.94043	9.74959	9 24
1 51	38.9	9.96943	9.58974	10 9	2 37	49.7	9.93969	9.75266	9 23
1 52	35.0	9.96888	9.59388	10 8	2 38	43.5	9.93895	9.75571	9 22
1 53	31.0	9.96833	9.59798	10 7	2 39	37.3	9.93820	9.75875	9 21
1 54	26.9	9.96777	9.60204	10 6	2 40	31.1	9.93745	9.76177	9 20
1 55	22.8	9.96721	9.60607	10 5	2 41	24.8	9.93669	9.76477	9 19
1 56	18.7	9.96665	9.61007	10 4	2 42	18.4	9.93593	9.76776	9 18
1 57	14.6	9.96608	9.61404	10 3	2 43	12.0	9.93517	9.77073	9 17
1 58	10.4	9.96551	9.61798	10 2	2 44	43 5.5	9.93440	9.77369	9 16
1 59	6.1	9.96493	9.62189	10 1	2 45	42 59.0	9.93363	9.77663	9 15
2 0	47 1.8	9.96434	9.62578	10 0	2 46	52.4	9.93286	9.77956	9 14
2 1	46 57.5	9.96375	9.62963	9 59	2 47	45.7	9.93208	9.78247	9 13
2 2	53.1	9.96316	9.63346	9 58	2 48	39.0	9.93130	9.78536	9 12
2 3	48.7	9.96256	9.63726	9 57	2 49	32.3	9.93051	9.78824	9 11
2 4	44.2	9.96196	9.64103	9 56	2 50	25.5	9.92972	9.79111	9 10
2 5	39.7	9.96136	9.64477	9 55	2 51	18.6	9.92893	9.79396	9 9
2 6	35.1	9.96075	9.64849	9 54	2 52	11.7	9.92814	9.79680	9 8
2 7	30.5	9.96013	9.65218	9 53	2 53	42 4.7	9.92734	9.79962	9 7
2 8	25.8	9.95951	9.65585	9 52	2 54	41 57.6	9.92654	9.80243	9 6
2 9	21.1	9.95889	9.65949	9 51	2 55	50.5	9.92573	9.80522	9 5
2 10	16.4	9.95826	9.66311	9 50	2 56	43.3	9.92492	9.80800	9 4
2 11	11.6	9.95763	9.66670	9 49	2 57	36.1	9.92411	9.81077	9 3
2 12	6.7	9.95699	9.67027	9 48	2 58	28.8	9.92329	9.81352	9 2
2 13	46 1.8	9.95635	9.67382	9 47	2 59	21.5	9.92247	9.81626	9 1
2 14	45 56.8	9.95570	9.67734	9 46	3 0	14.1	9.92165	9.81898	9 0
2 15	51.9	9.95505	9.68084	9 45	3 1	41 6.6	9.92083	9.82169	8 59
2 16	46.9	9.95440	9.68432	9 44	3 2	40 59.1	9.92000	9.82439	8 58
2 17	41.8	9.95374	9.68777	9 43	3 3	51.5	9.91917	9.82708	8 57
2 18	45 36.7	9.95308	9.69120	9 42	3 4	40 43.9	9.91834	9.82975	8 56

For hour angles between 12^h and 24^h, add 12^h to the preceding argument. *N* has the sign of the cosine of the hour angle; tan *n* that of the sine.

t	*N*	cos *n*	tan *n*	*t*	*t*	*N*	cos *n*	tan *n*	*t*
h. m.	° ′			h. m.	h. m.	° ′			h. m.
3 4	40 43.9	9.91834	9.82975	8 56	3 50	33 39.9	9.87760	9.93958	8 10
3 5	36.2	9.91750	9.83241	8 55	3 51	29.0	9.87669	9.94170	8 9
3 6	28.4	9.91666	9.83506	8 54	3 52	18.0	9.87577	9.94380	8 8
3 7	20.5	9.91582	9.83769	8 53	3 53	33 6.9	9.87486	9.94589	8 7
3 8	12.6	9.91497	9.84031	8 52	3 54	32 55.8	9.87394	9.94797	8 6
3 9	40 4.7	9.91412	9.84292	8 51	3 55	44.6	9.87303	9.95004	8 5
3 10	39 56.7	9.91327	9.84551	8 50	3 56	33.3	9.87212	9.95210	8 4
3 11	48.6	9.91242	9.84809	8 49	3 57	22.0	9.87120	9.95415	8 3
3 12	40.4	9.91156	9.85066	8 48	3 58	32 10.5	9.87029	9.95618	8 2
3 13	32.2	9.91070	9.85322	8 47	3 59	31 59.0	9.86938	9.95820	8 1
3 14	23.9	9.90984	9.85577	8 46	4 0	47.4	9.86847	9.96021	8 0
3 15	15.5	9.90898	9.85830	8 45	4 1	35.7	9.86756	9.96221	7 59
3 16	39 7.1	9.90811	9.86082	8 44	4 2	24.0	9.86665	9.96420	7 58
3 17	38 58.7	9.90724	9.86333	8 43	4 3	12.1	9.86574	9.96617	7 57
3 18	50.1	9.90637	9.86583	8 42	4 4	31 0.2	9.86483	9.96813	7 56
3 19	41.5	9.90550	9.86831	8 41	4 5	30 48.3	9.86393	9.97009	7 55
3 20	32.8	9.90462	9.87078	8 40	4 6	36.2	9.86302	9.97203	7 54
3 21	24.1	9.90374	9.87324	8 39	4 7	24.0	9.86212	9.97395	7 53
3 22	15.3	9.90286	9.87569	8 38	4 8	30 11.8	9.86121	9.97586	7 52
3 23	38 6.4	9.90198	9.87813	8 37	4 9	29 59.5	9.86031	9.97777	7 51
3 24	37 57.4	9.90110	9.88056	8 36	4 10	47.1	9.85941	9.97966	7 50
3 25	48.4	9.90021	9.88297	8 35	4 11	34.7	9.85852	9.98154	7 49
3 26	39.3	9.89932	9.88537	8 34	4 12	22.1	9.85762	9.98341	7 48
3 27	30.2	9.89843	9.88776	8 33	4 13	29 9.5	9.85673	9.98526	7 47
3 28	21.0	9.89754	9.89014	8 32	4 14	28 56.8	9.85584	9.98710	7 46
3 29	11.7	9.89665	9.89251	8 31	4 15	44.0	9.85495	9.98894	7 45
3 30	37 2.3	9.89575	9.89487	8 30	4 16	31.1	9.85406	9.99076	7 44
3 31	36 52.9	9.89485	9.89721	8 29	4 17	18.2	9.85318	9.99256	7 43
3 32	43.4	9.89395	9.89954	8 28	4 18	28 5.2	9.85229	9.99435	7 42
3 33	33.8	9.89305	9.90186	8 27	4 19	27 52.1	9.85141	9.99613	7 41
3 34	24.1	9.89215	9.90417	8 26	4 20	38.9	9.85054	9.99789	7 40
3 35	14.4	9.89125	9.90647	8 25	4 21	25.6	9.84966	9.99964	7 39
3 36	36 4.6	9.89035	9.90876	8 24	4 22	27 12.3	9.84879	0.00138	7 38
3 37	35 54.8	9.88944	9.91104	8 23	4 23	26 58.9	9.84793	0.00311	7 37
3 38	44.8	9.88854	9.91330	8 22	4 24	45.4	9.84706	0.00482	7 36
3 39	34.8	9.88763	9.91555	8 21	4 25	31.8	9.84620	0.00652	7 35
3 40	24.7	9.88672	9.91779	8 20	4 26	18.1	9.84534	0.00821	7 34
3 41	14.6	9.88581	9.92002	8 19	4 27	26 4.4	9.84449	0.00988	7 33
3 42	35 4.4	9.88490	9.92224	8 18	4 28	25 50.6	9.84364	0.01154	7 32
3 43	34 54.1	9.88399	9.92445	8 17	4 29	36.7	9.84279	0.01318	7 31
3 44	43.7	9.88308	9.92665	8 16	4 30	22.7	9.84195	0.01481	7 30
3 45	33.2	9.88217	9.92883	8 15	4 31	25 8.6	9.84111	0.01643	7 29
3 46	22.7	9.86126	9.93100	8 14	4 32	24 54.5	9.84028	0.01804	7 28
3 47	12.1	9.88034	9.93316	8 13	4 33	40.3	9.83945	0.01963	7 27
3 48	34 1.4	9.87943	9.93531	8 12	4 34	26.0	9.83863	0.02120	7 26
3 49	33 50.7	9.87852	9.98745	8 11	4 35	24 11.6	9.83780	0.02277	7 25
3 50	33 39.9	9.87760	9.93958	8 10	4 36	23 57.1	9.83699	0.02432	7 24

For hour angles between 12^h and 24^h, add 12^h to the preceding argument. *N* has the sign of the cosine of the hour angle; tan *n* that of the sine.

t	N	cos n	tan n	t	t	N	cos n	tan n	t
h. m.	° ′			h. m.	h. m.	° ′			h. m.
4 36	23 57.1	9.83699	0.02432	7 24	5 18	12 43.7	9.80869	0.07513	6 42
4 37	42.6	9.83618	0.02585	7 23	5 19	26.3	9.80820	0.07597	6 41
4 38	28.0	9.83537	0.02737	7 22	5 20	12 8.9	9.80772	0.07679	6 40
4 39	23 13.3	9.83457	0.02887	7 21	5 21	11 51.3	9.80724	0.07759	6 39
4 40	22 58.5	9.09377	0.03036	7 20	5 22	33.7	9.80678	0.07837	6 38
4 41	43.6	9.83298	0.03184	7 19	5 23	11 16.1	9.80633	0.07913	6 37
4 42	28.7	9.83220	0.03330	7 18	5 24	10 58.4	9.80590	0.07987	6 36
4 43	22 13.7	9.83142	0.03475	7 17	5 25	40.7	9.80547	0.08060	6 35
4 44	21 58.6	9.83065	0.03618	7 16	5 26	23.0	9.80505	0.08131	6 34
4 45	43.5	9.82987	0.03759	7 15	5 27	10 5.1	9.80464	0.08199	6 33
4 46	28.2	9.82911	0.03899	7 14	5 28	9 47.3	9.80425	0.08265	6 32
4 47	21 12.9	9.82836	0.04038	7 13	5 29	29.4	9.80387	0.08330	6 31
4 48	20 57.6	9.82761	0.04175	7 12	5 30	9 11.4	9.80349	0.08393	6 30
4 49	42.1	9.82687	0.04310	7 11	5 31	8 53.5	9.80313	0.08454	6 29
4 50	26.6	9.82613	0.04444	7 10	5 32	35.4	9.80278	0.08512	6 28
4 51	20 11.0	9.82540	0.04576	7 9	5 33	8 17.4	9.80244	0.08568	6 27
4 52	19 55.3	9.82468	0.04707	7 8	5 34	7 59.3	9.80212	0.08623	6 26
4 53	39.5	9.82396	0.04836	7 7	5 35	41.1	9.80180	0.08676	6 25
4 54	23.7	9.82325	0.04963	7 6	5 36	23.0	9.80150	0.08727	6 24
4 55	19 7.8	9.82255	0.05089	7 5	5 37	7 4.8	9.80120	0.08776	6 23
4 56	18 51.8	9.82186	0.05213	7 4	5 38	6 46.5	9.80092	0.08822	6 22
4 57	35.8	9.82117	0.05336	7 3	5 39	28.3	9.80066	0.08867	6 21
4 58	19.7	9.82049	0.05457	7 2	5 40	6 10.0	9.80040	0.08909	6 20
4 59	18 3.5	9.81982	0.05576	7 1	5 41	5 51.6	9.80016	0.08950	6 19
5 0	17 47.3	9.81915	0.05694	7 0	5 42	33.3	9.79993	0.08988	6 18
5 1	30.9	9.81850	0.05810	6 59	5 43	5 14.9	9.79971	0.09025	6 17
5 2	17 14.5	9.81785	0.05924	6 58	5 44	4 56.5	9.79950	0.09060	6 16
5 3	16 58.1	9.81721	0.06037	6 57	5 45	38.1	9.79930	0.09092	6 15
5 4	41.6	9.81658	0.06148	6 56	5 46	19.7	9.79912	0.09122	6 14
5 5	25.0	9.81596	0.06257	6 55	5 47	4 1.2	9.79895	0.09150	6 13
5 6	16 8.3	9.81534	0.06364	6 54	5 48	3 42.7	9.79879	0.09176	6 12
5 7	15 51.6	9.81474	0.06470	6 53	5 49	24.2	9.79865	0.09200	6 11
5 8	34.8	9.81414	0.06574	6 52	5 50	3 5.7	9.79852	0.09222	6 10
5 9	18.0	9.81355	0.06676	6 51	5 51	2 47.2	9.79840	0.09242	6 9
5 10	15 1.1	9.81297	0.06776	6 50	5 52	28.6	9.79829	0.09260	6 8
5 11	14 44.1	9.81240	0.06874	6 49	5 53	2 10.1	9.79819	0.09276	6 7
5 12	27.1	9.81184	0.06971	6 48	5 54	1 51.5	9.79811	0.09289	6 6
5 13	14 10.0	9.81129	0.07066	6 47	5 55	32.9	9.79804	0.09301	6 5
5 14	13 52.9	9.81075	0.07159	6 46	5 56	1 14.4	9.79798	0.09311	6 4
5 15	35.7	9.81022	0.07250	6 45	5 57	0 55.8	9.79794	0.09318	6 3
5 16	18.4	9.80970	0.07340	6 44	5 58	37.2	9.79791	0.09323	6 2
5 17	13 1.1	9.80919	0.07427	6 43	5 59	18.6	9.79789	0.09326	6 1
5 18	12 43.7	9.80869	0.07513	6 42	6 0	0 0.0	9.79788	0.09327	6 0

For hour angles between 12^h and 24^h, add 12^h to the preceding argument. N has the sign of the cosine of the hour angle; tan n that of the sine.

True Z. D.	Log a	A	λ	True Z. D.	Log a	A	λ
°				° ′			
0	1.76143	. .	. .	77 0	1.75005	0.9975	1.0197
10	.76141	. .	. .	10	.74976	.9974	.0202
20	.76135	. .	. .	20	.74945	.9973	.0208
30	.76122	. .	. .	30	.74914	.9972	.0213
35	.76112	. .	. .	40	.74882	.9971	.0219
40	.76099	. .	. . .	50	.74848	.9970	.0226
45	.76080	. .	1.0013	78 0	.74813	.9970	.0234
46	.76075	. .	.0013	10	.74777	.9969	.0241
47	.76070	. .	.0014	20	.74740	.9968	.0249
48	.76065	. .	.0015	30	.74701	.9967	.0257
49	.76059	. .	.0015	40	.74660	.9967	.0265
50	.76053	. .	.0016	50	.74617	.9966	.0273
51	.76047	. .	.0017	79 0	.74573	.9965	.0281
52	.76040	. .	.0018	10	.74527	.9964	.0289
53	.76032	. .	.0019	20	.74478	.9963	.0296
54	.76024	. .	.0021	30	.74428	.9962	.0304
55	.76014	. .	.0024	40	.74376	.9961	.0312
56	.76004	. .	.0026	50	.74321	.9960	.0320
57	.75993	. .	.0028	80 0	.74263	.9958	.0329
58	.75981	. .	.0030	10	.74203	.9957	.0337
59	.75967	. .	.0032	20	.74141	.9955	.0346
60	.75953	. .	.0035	30	.74075	.9954	.0354
61	.75937	. .	.0038	40	.74005	.9952	.0363
62	.75919	. .	.0041	50	.73933	.9951	.0372
63	.75899	. .	.0044	81 0	.73857	.9949	.0382
64	.75877	. .	.0048	10	.73777	.9948	.0393
65	.75852	. .	.0052	20	.73692	.9946	.0404
66	.75824	. .	.0058	30	.73605	.9944	.0416
67	.75793	. .	.0064	40	.73514	.9942	.0429
68	.75757	. .	.0071	50	.73417	.9940	.0444
69	.75717	. .	.0079	82 0	.73314	.9938	.0459
70	.75670	. .	.0088	10	.73207	.9936	.0476
71	.75615	. .	.0099	20	.73095	.9934	.0493
72	.75552	. .	.0110	30	.72974	.9931	.0512
73	.75478	. .	.0123	40	.72846	.9929	.0531
74 ′	.75390	. .	.0140	50	.72711	.9926	.0552
75 0	.75284	. .	.0155	83 0	.72569	.9924	.0573
10	.75265	. .	.0158	10	.72418	.9920	.0594
20	.75245	. .	.0161	20	.72256	.9917	.0617
30	.75225	. .	.0164	30	.72083	.9913	.0640
40	.75204	. .	.0167	40	.71902	.9909	.0664
50	.75182	. .	.0170	50	.71708	.9905	.0688
76 0	.75159	. .	.0173	84 0	.71499	.9901	.0715
10	.75136	. .	.0177	10	.71276	.9897	.0742
20	.75112	. .	.0180	20	.71037	.9893	.0771
30	.75087	. .	.0184	30	.70782	.9888	.0802
40	.75060	. .	.0188	40	.70509	.9882	.0834
50	.75033	. .	.0192	50	.70216	.9876	.0868
77 0	1.75005	0.9975	1.0197	85 0	1.69902	0.9870	1.0903

$$k = a\,\beta^{A}\,\gamma^{\lambda}.$$

The argument is the true zenith distance.

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